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United States Patent [19]

Martin

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[45] **Date of Patent: Aug. 9, 1994**

[54] **FLYING PASTER**

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[73] Assignee: **Martin Automatic, Inc.,** Rockford, Ill.

[21] Appl. No.: **136,169**

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Related U.S. Application Data

[62] Division of Ser. No. 935,859, Aug. 26, 1992, abandoned.

[51] **Int. Cl.**[5] **B65H 19/16;** B65H 19/18

[52] **U.S. Cl.** **242/555.4;** 242/556; 242/596.5

[58] **Field of Search** 242/58.1, 58.2, 58.3, 242/58.4, 58.6

[56] **References Cited**

U.S. PATENT DOCUMENTS

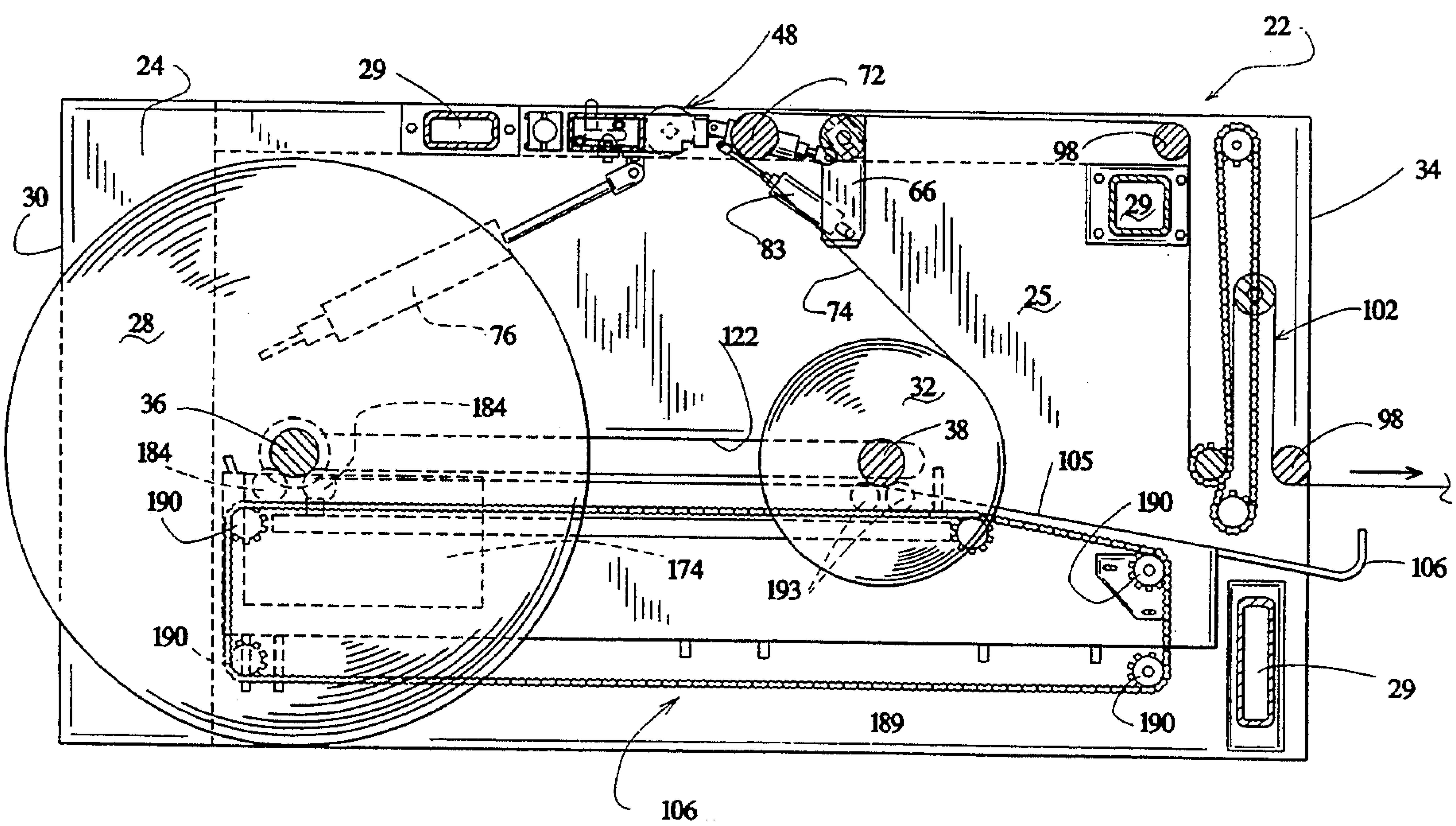
4,564,150 1/1986 Keene et al. 242/58.1
4,729,522 3/1988 Tafel .... 242/58.3 X
4,875,633 10/1989 Mochizuki et al. 242/58.3
4,934,621 6/1990 Jacobs 242/58.3

Primary Examiner—John M. Jillions
Attorney, Agent, or Firm—McAndrews, Held & Malloy, Ltd.

[57] **ABSTRACT**

A flying paster is disclosed that achieves straight across splicing by utilizing web roll core drive technology. Splice calculations are based on input data sensed during preliminary acceleration of the new roll, which is disposed in a splicing position in the flying paster. Acceleration of the new roll is achieved by engagement between the center core shaft of a new roll and a movable brake and roll accelerator assembly. Then, calculations facilitate speed matching between the web running from a second, running roll mounted in the flying paster and the new roll. Splicing is facilitated by the utilization of two, two-sided adhesive strips. One adhesive strip is used to adhere the leading end of the new roll to the rest of the body of the new roll during the pre-splice speed matching, and the second adhesive strip is used for adhering the leading end of the new roll with the newly cut, trailing end of the running web. After splicing, the new, now-running web roll and the movable brake and roll accelerator assembly are moved from the splicing position to an operating position in the flying paster. In the latter position, control over the new, now-running roll is transferred from the movable brake and roll accelerator assembly to a fixed brake and brake accelerator assembly disposed in the flying paster adjacent to the operating position. The movable brake and roll accelerator assembly are then returned to a position adjacent the splicing position so as to be ready for the next, new roll.

8 Claims, 10 Drawing Sheets



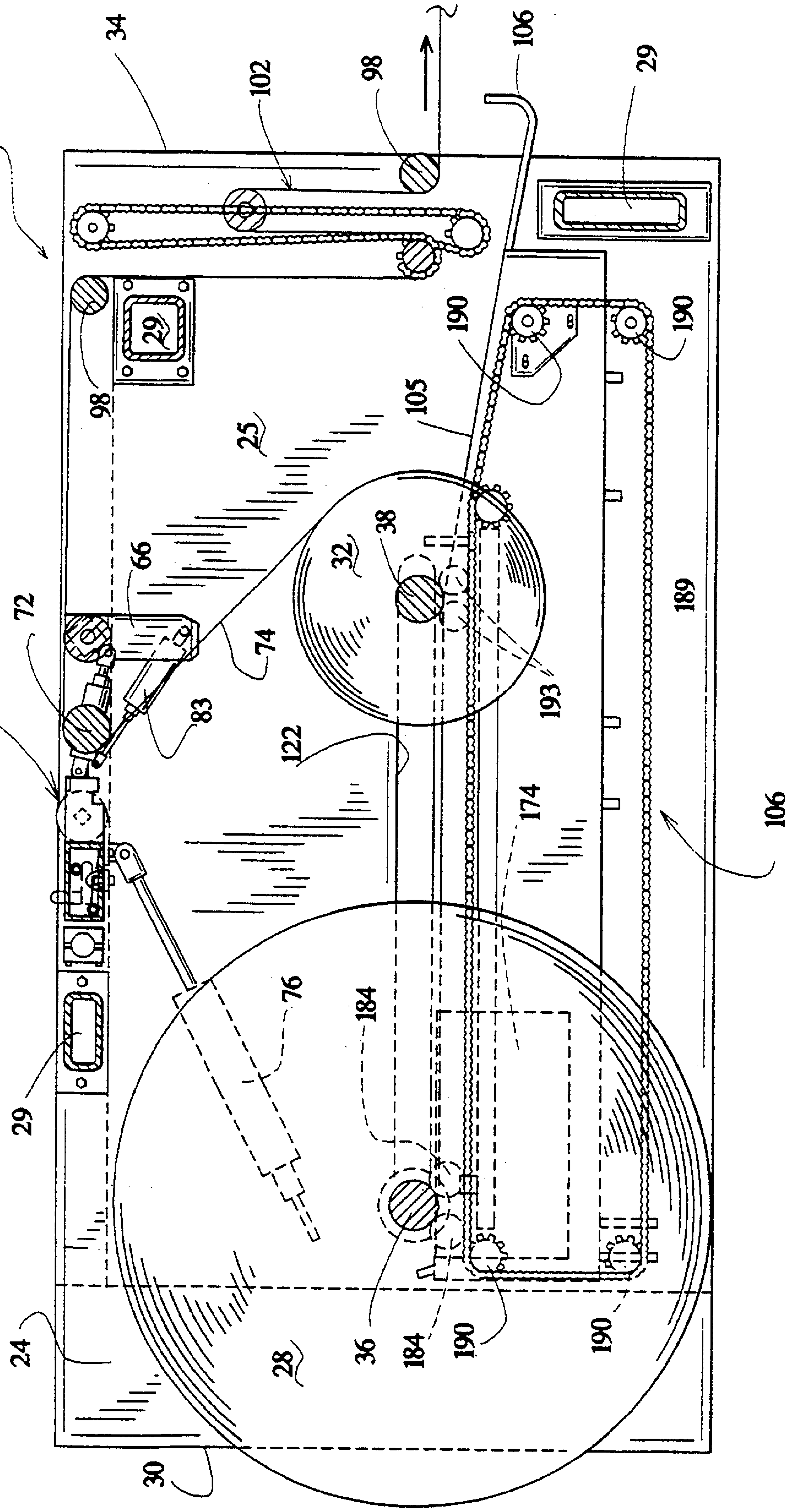

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FIG. 1

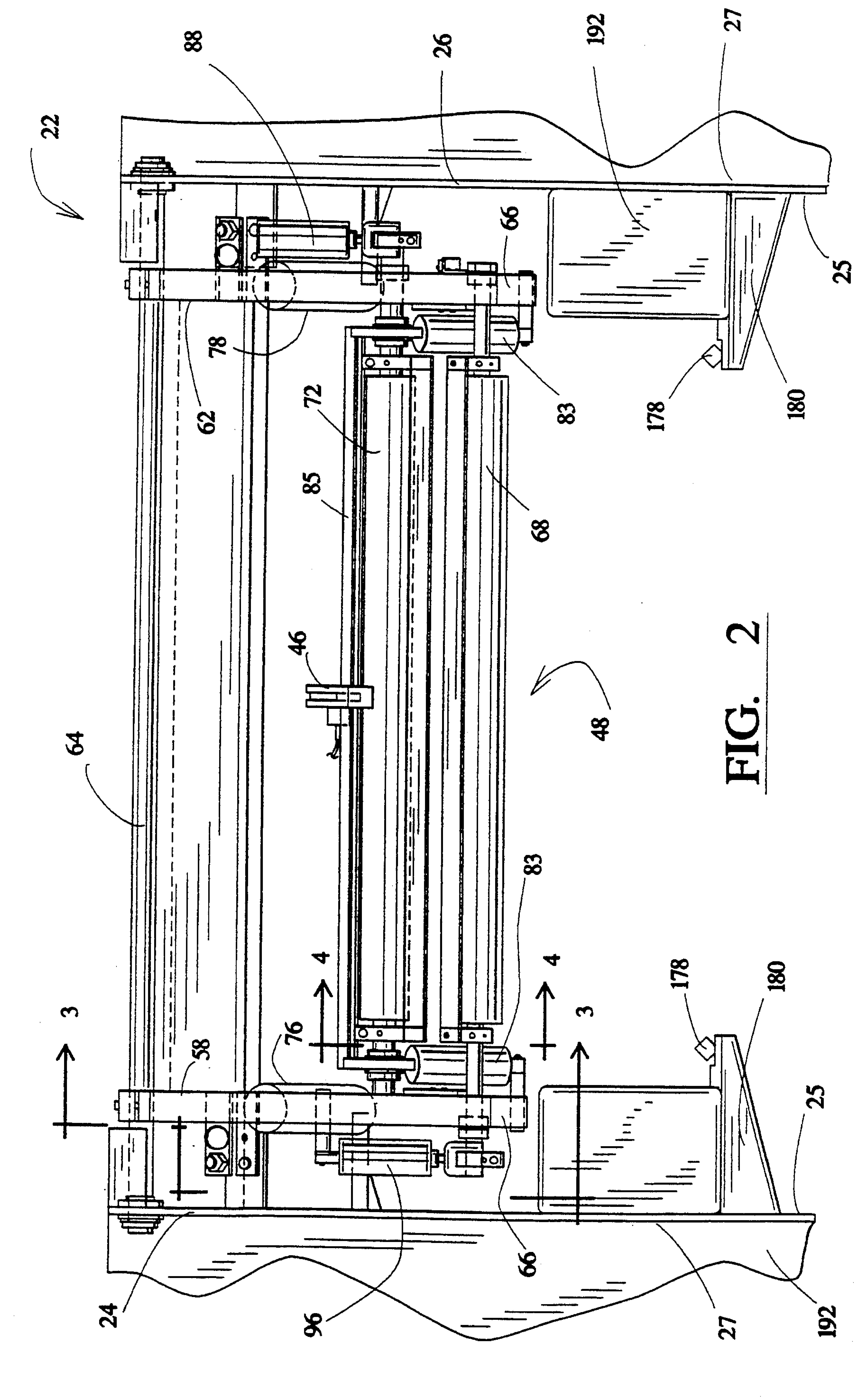


FIG. 2

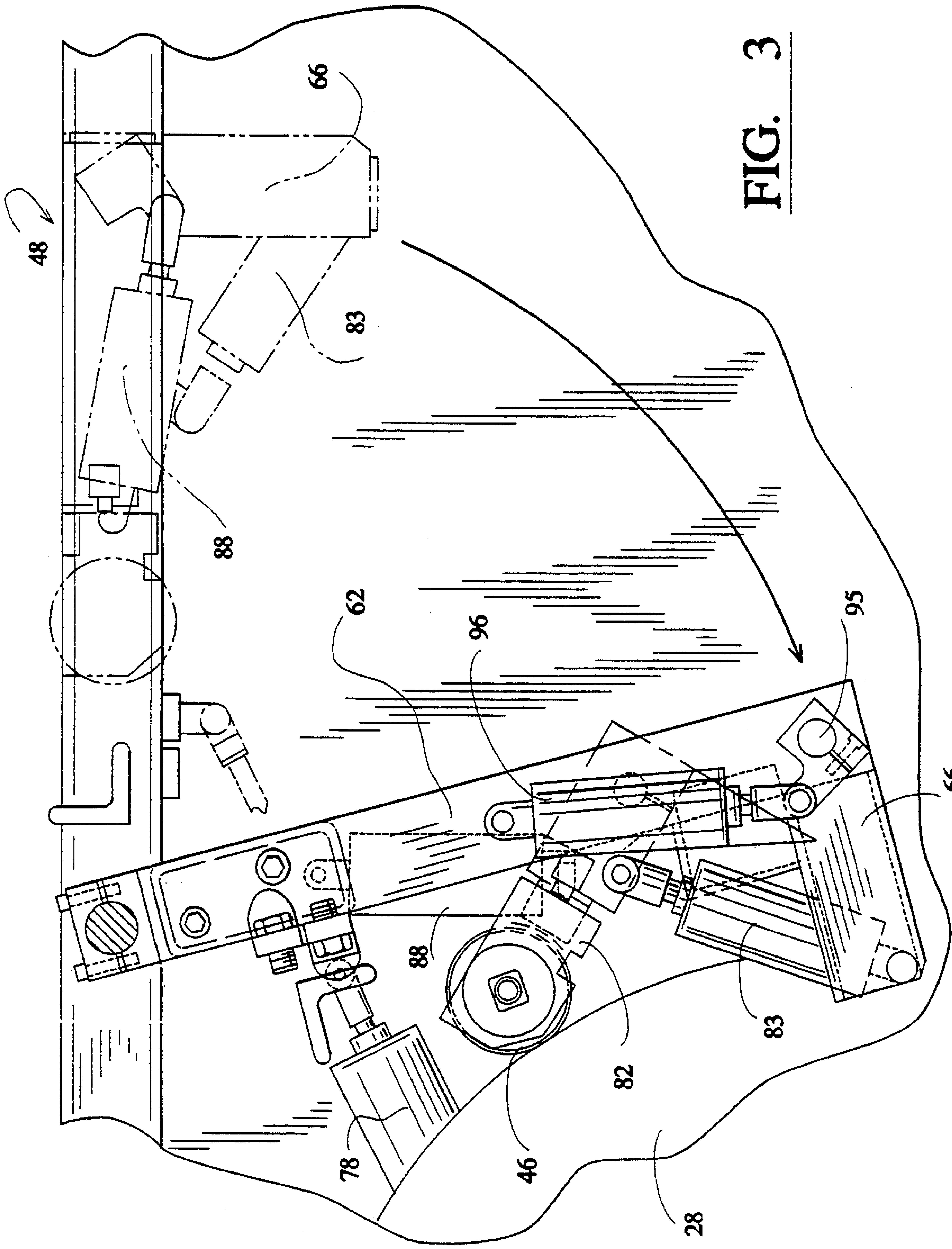
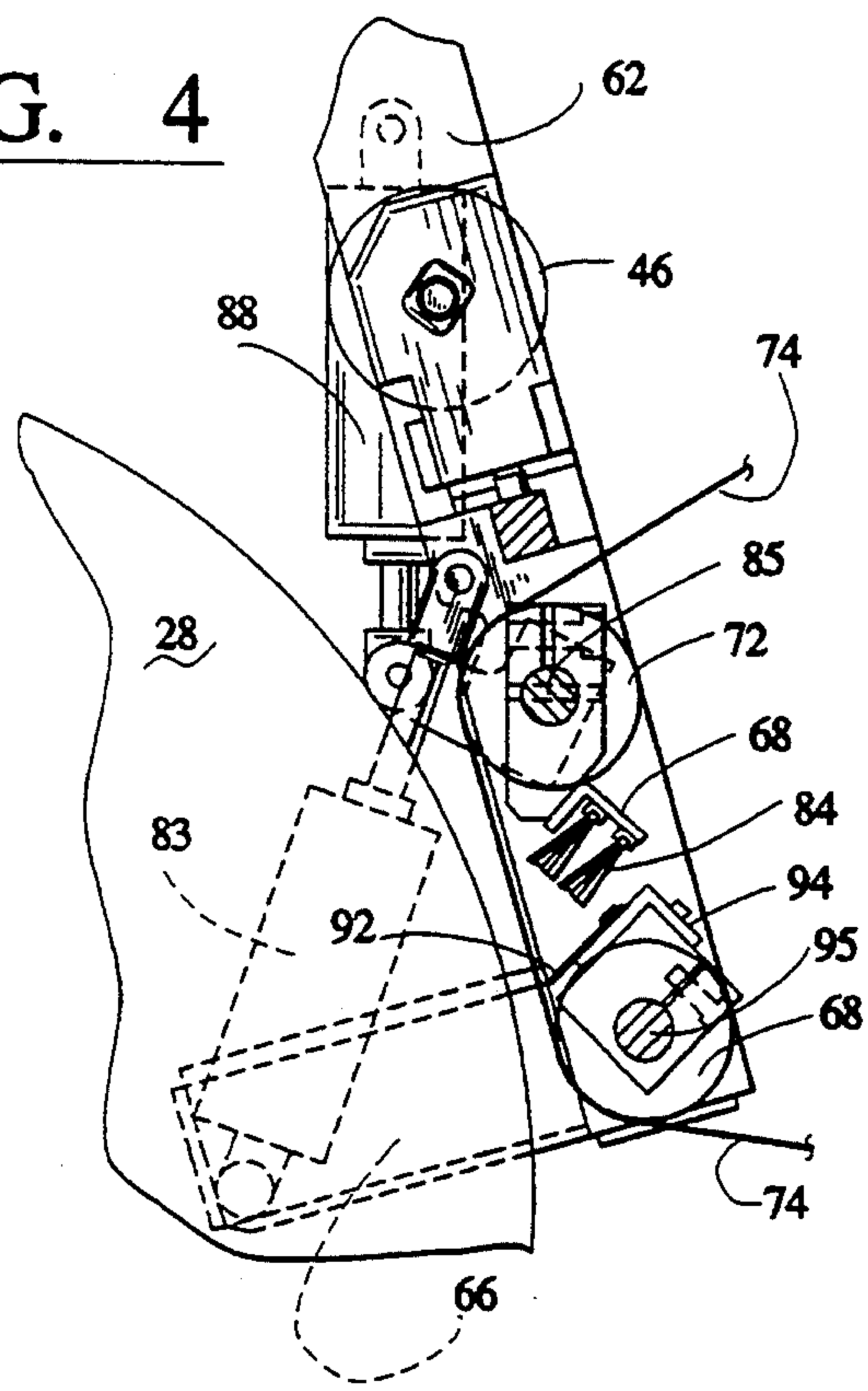
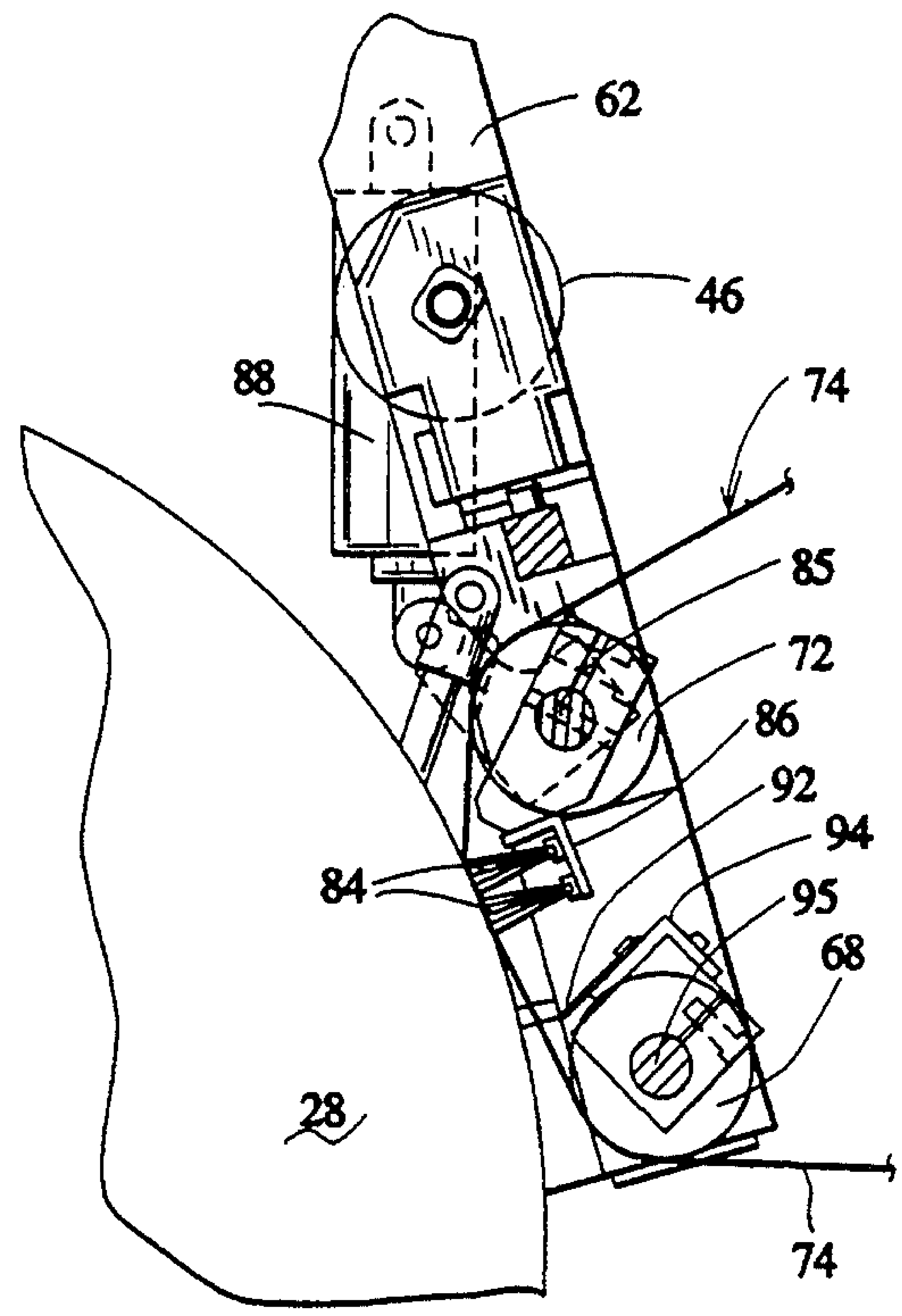


FIG. 3

FIG. 4





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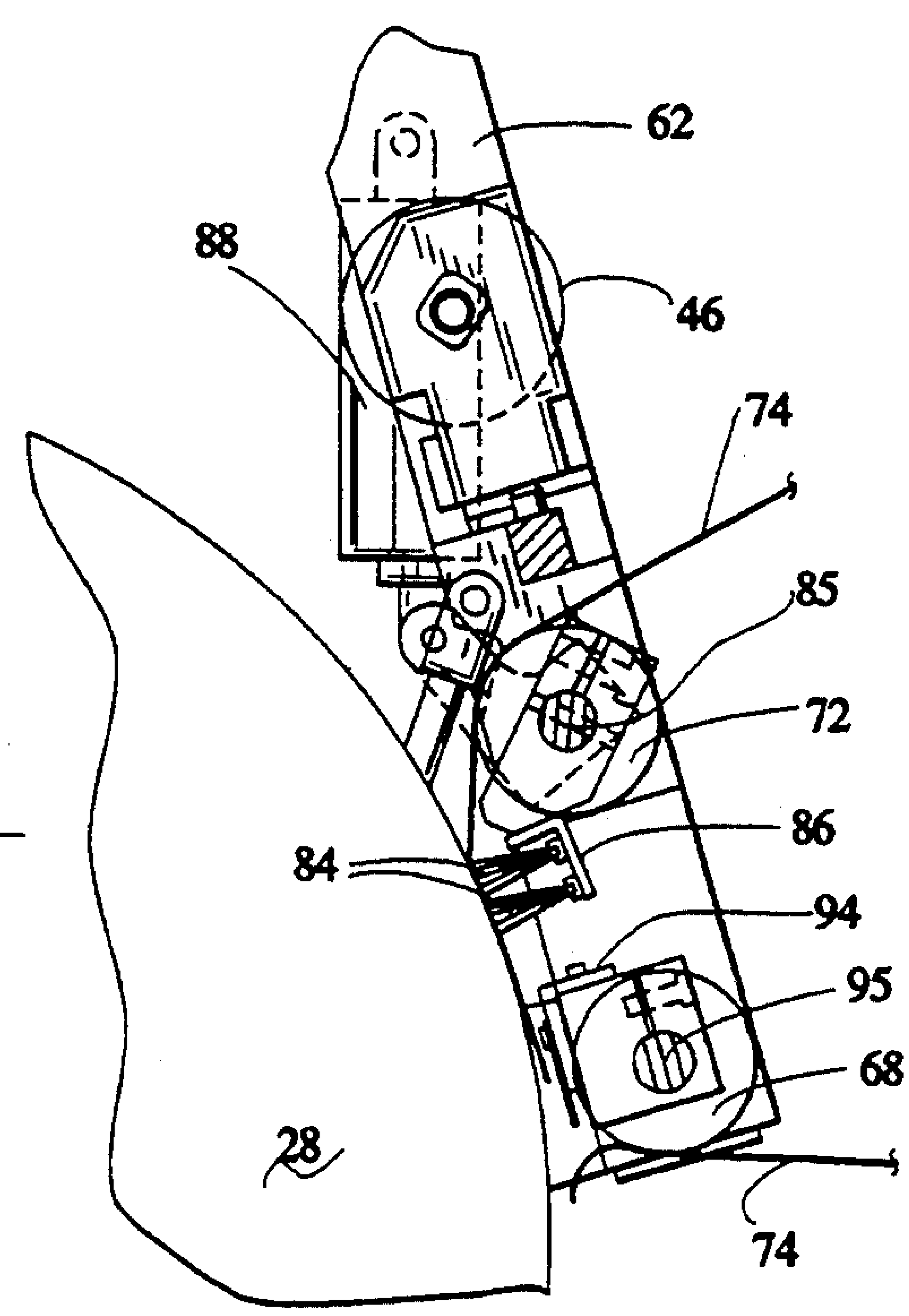

FIG. 6

FIG. 7

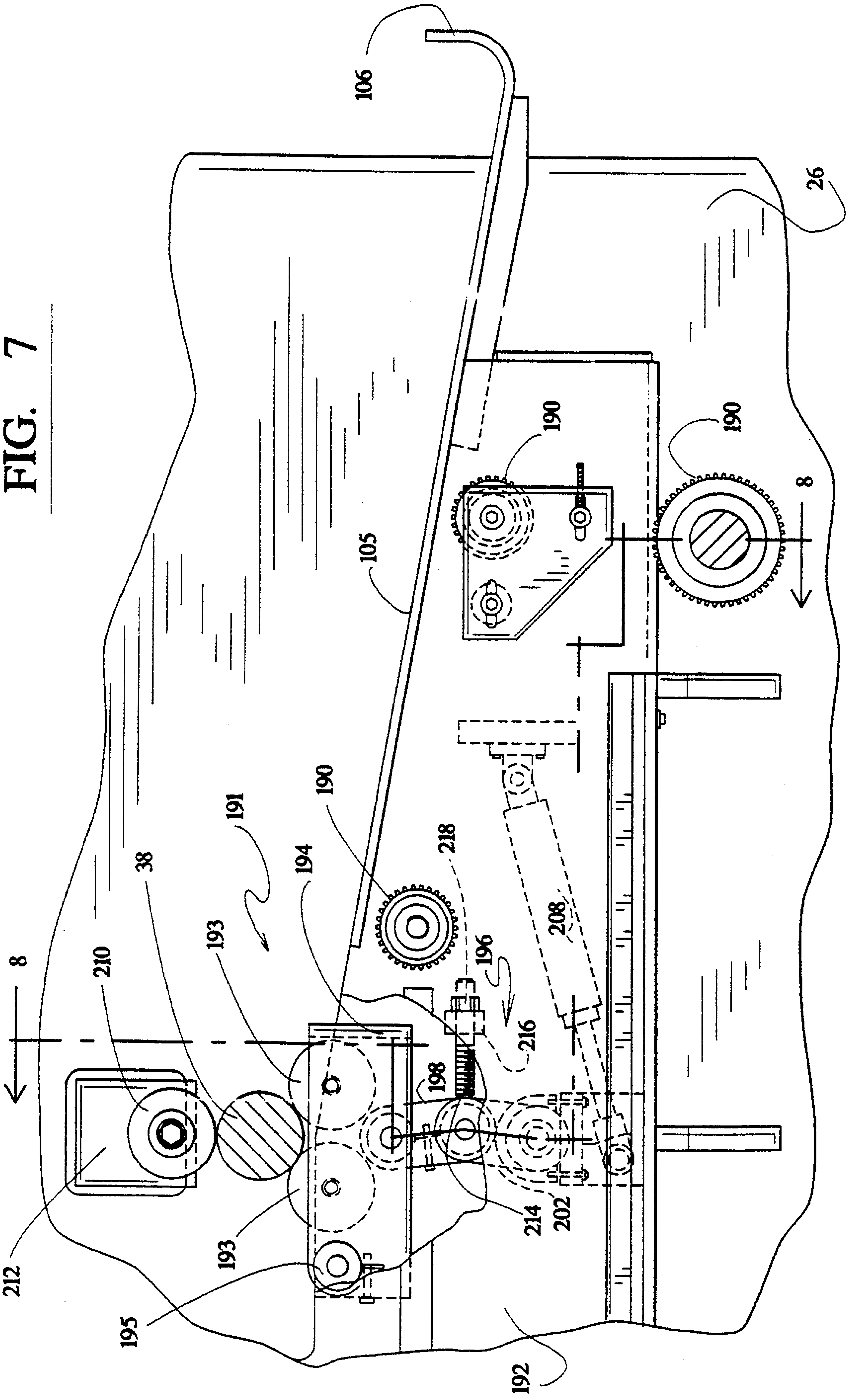
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FIG. 8

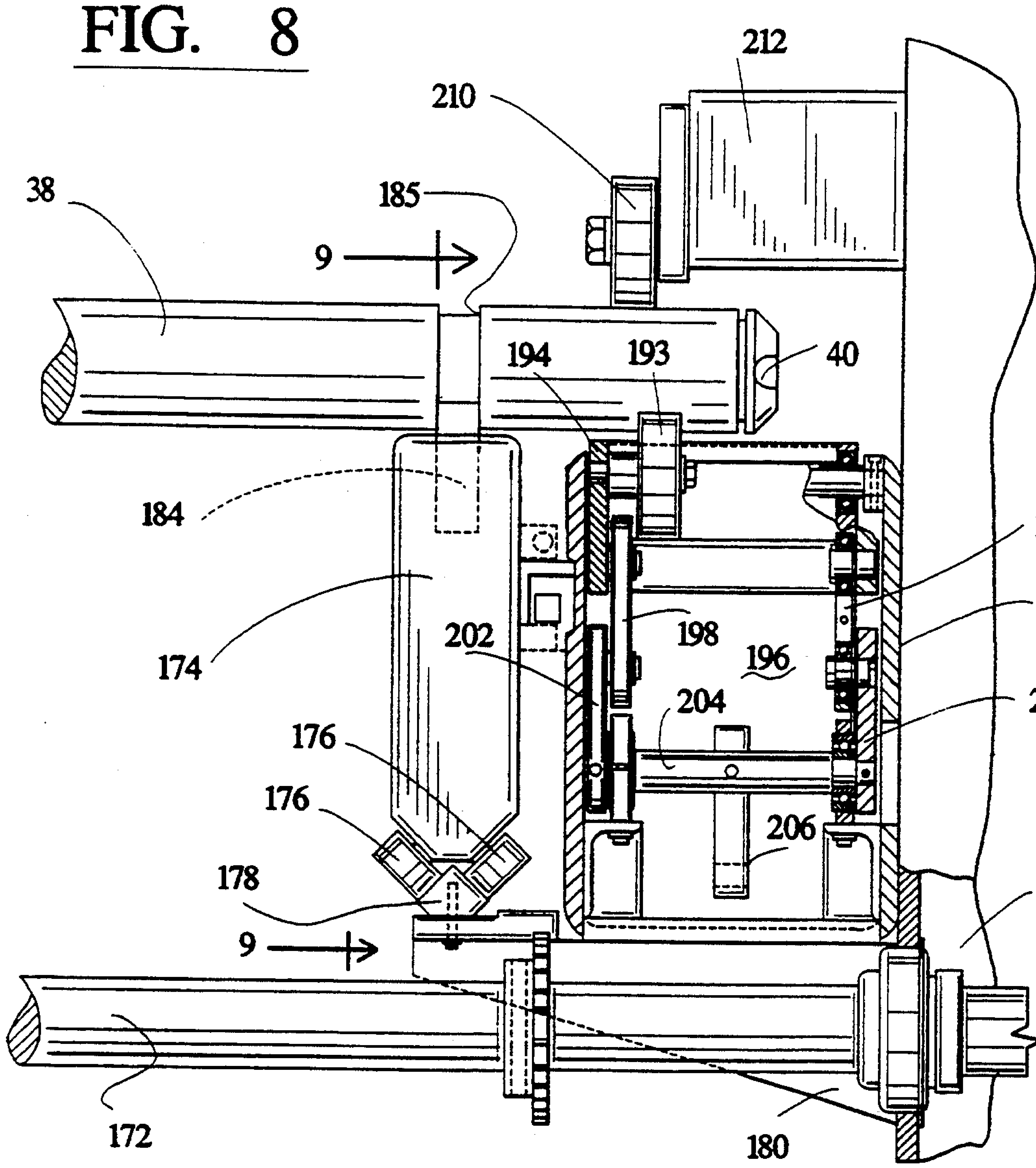

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FIG. 9

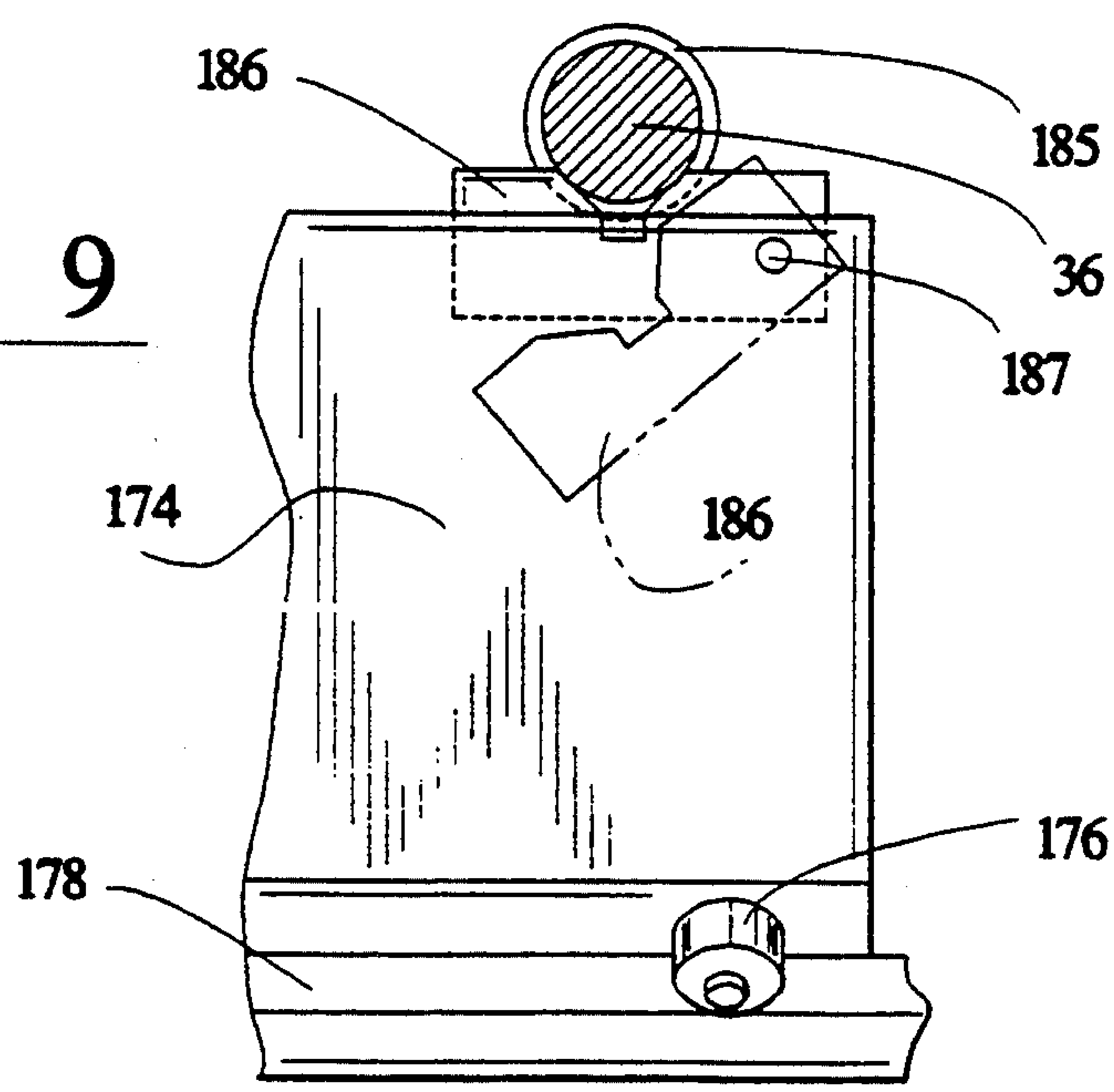

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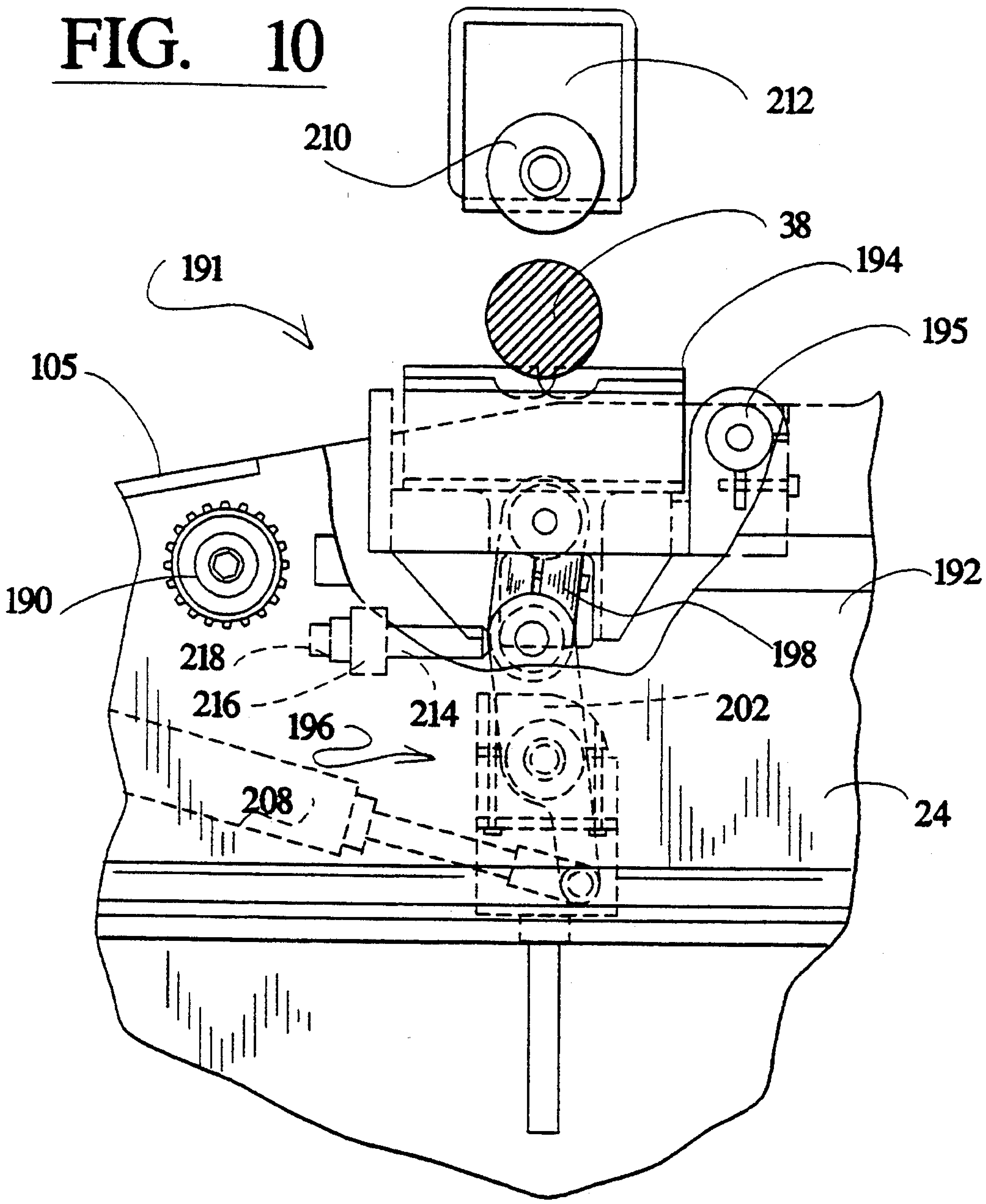
FIG. 10



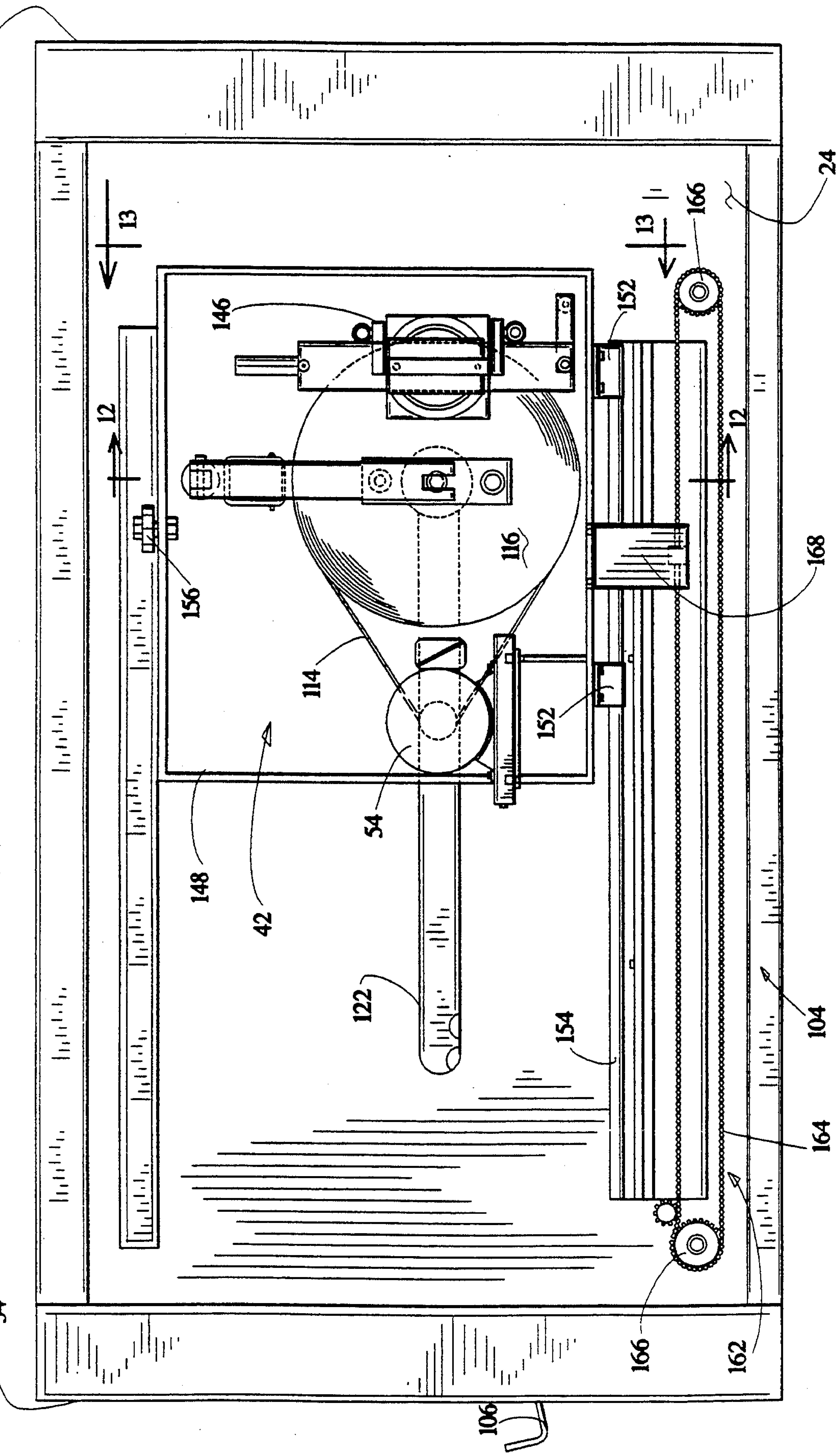

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FIG. 11

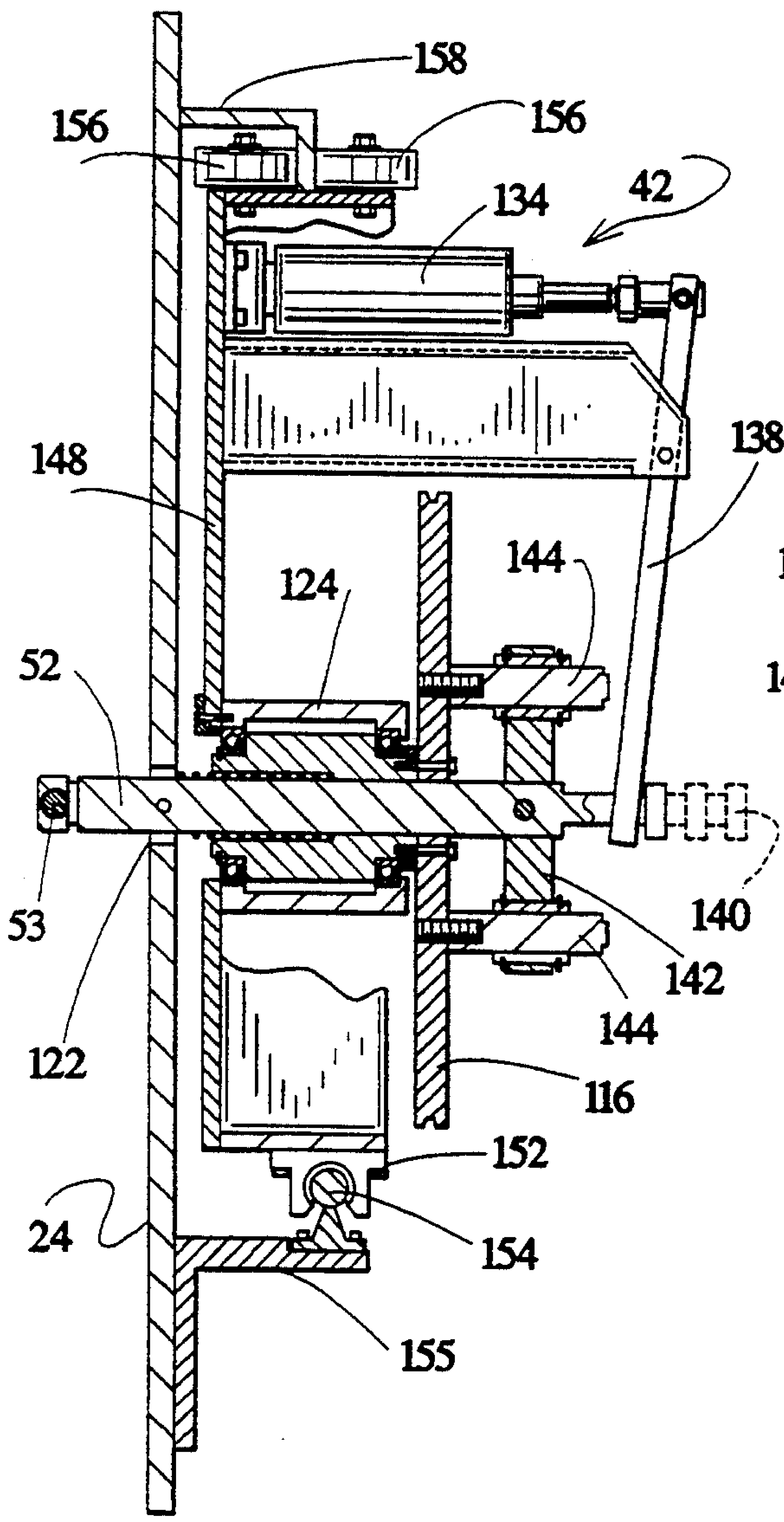
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FIG. 12

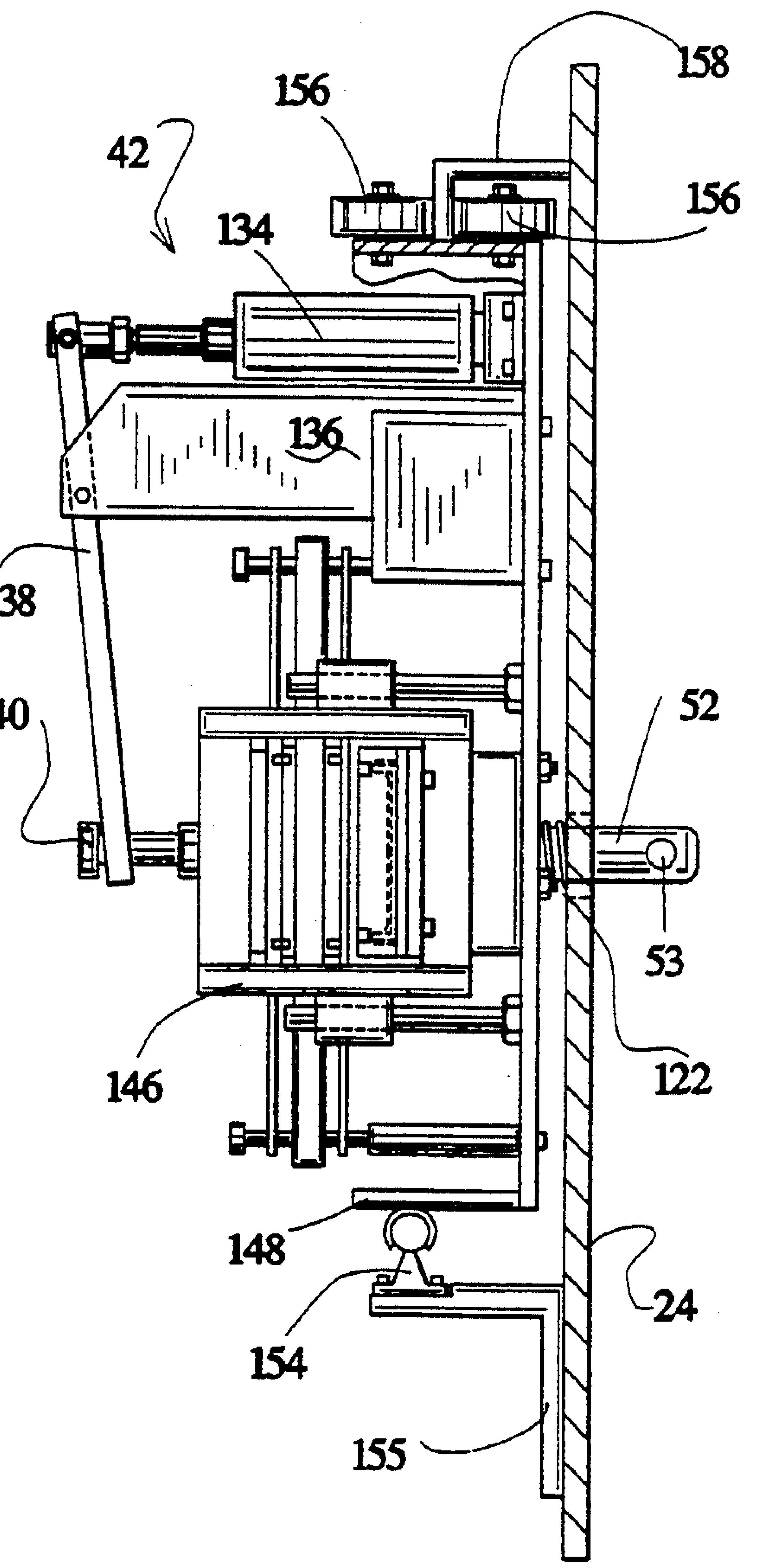
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FIG. 13

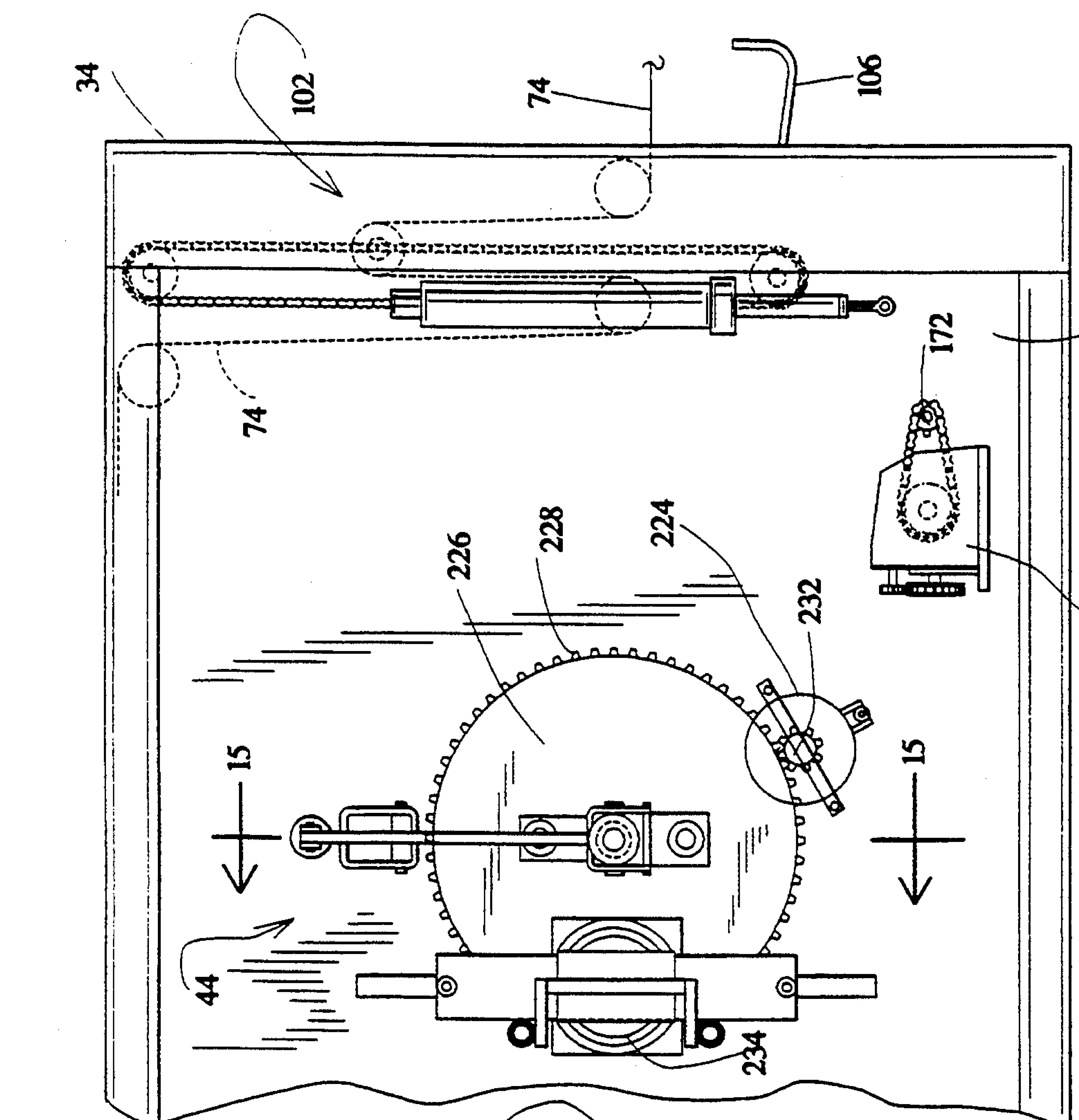
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FIG. 14

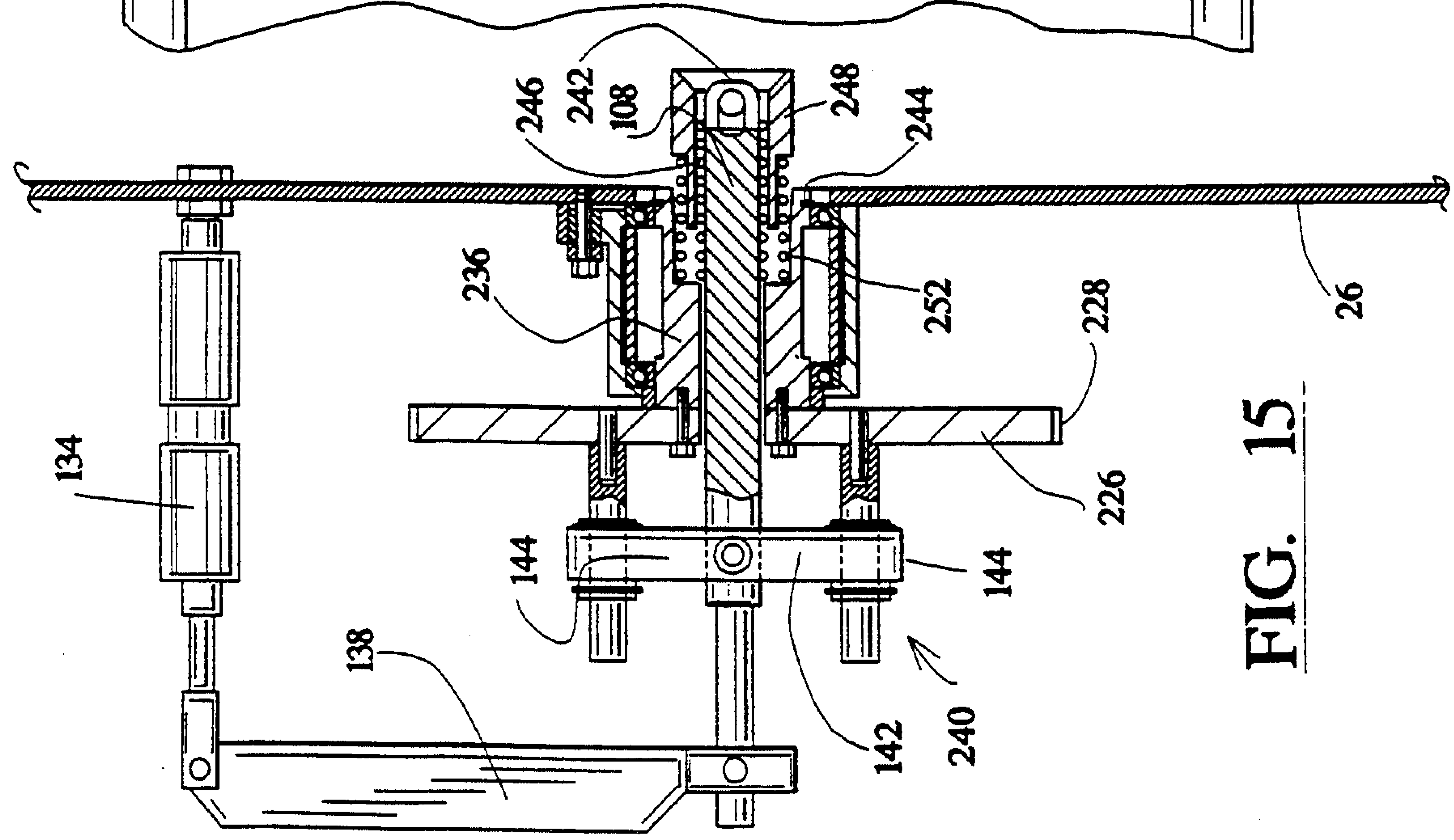
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FIG. 15

FLYING PASTER

This is a divisional application of application Ser. No. 07/935,859, filed Aug. 26, 1992, now abandoned.

BACKGROUND OF THE INVENTION

This invention relates to a flying paster, and more particularly, to a flying paster used to splice the leading end of a web from a new roll to the trailing end of a web running from a second roll. The splice is made while both rolls are being rotated at running web speed and while the running web is maintained under full brake/-tension control.

Various types of flying pasters have been available and used for years in the web handling industry usually as an option or alternative to zero-speed web splicers. Flying pasters have found particular utility in newspaper printing press applications, that is, for splicing rolls of news print stock being fed to newspaper printing presses. In such applications, especially when the printing presses are housed in older buildings where useable floor space is at a premium, the ability to arrange flying pasters in vertical stacks has proved to be a marketable advantage.

In the past, flying pasters have had recognized practical problems which have limited their application and utility. These problems include the need to apply surface belts to the surfaces of the new rolls in order to drive the new rolls up to a speed matching the speed of the running web, and in some instances, to maintain web tension control after a splice. These surface belts have a disadvantage in that they tend to disturb the surface fibers of the web and prevent the use of simple splice preparations, as compared with zero-speed-splicer splice preparations. Indeed, most flying paster splice preparations are relatively complex, requiring the use of tabs, and precluding the use of continuous, straight-across splices achieved by a single strip of transfer adhesive. Additionally, prior commercially available flying pasters have required relatively expensive DC drives or mechanical press connections.

In sum, the concept of a flying paster, that is, splicing webs without stopping the running of the webs, is excellent in theory. Nonetheless, prior attempts to commercially employ this concept have encountered serious practical drawbacks that have generally relegated the flying paster to a second choice status as compared to zero-speed splicers. The need for an improved flying paster, which would realize the theoretical potential in a practical, work-a-day embodiment, has long been recognized by those working in the web handling industry.

SUMMARY OF THE INVENTION

In principal aspects, the improved flying paster of the present invention represents a unique, revolutionary approach that successfully overcomes traditional flying paster problems. Its design maintains a degree of simplicity far beyond that of competitive flying pasters. The creative use of core drive technology eliminates the need for surface drive belts and avoids the need for the more complicated, and expensive, DC drive packages or mechanical press drive connections. A straight across splice preparation also adds to the simplicity and ease of operation of the flying paster of the present invention. Key features of this invention can be applied to many different types or configurations of flying pasters, including side-by-side, turret and stackable versions.

Another significant advantage of the flying paster of the present invention includes its use of two full capacity brake and accelerator assemblies; a moveable one for the new roll, and a fixed one for the running roll. One or the other of these brake and accelerator assemblies is controlled, during all phases of operation, by a single roller, inertia compensated, pneumatically loaded, linear tension control dancer located at the output end of the flying paster. This assures that the unwinding roll is under positive tension control at all times. The moveable brake and accelerator assembly, which is connected with a new roll when it is loaded in the paster, stays with that roll through the entire splicing operation. It is not disconnected from the new roll until the fixed position brake and accelerator assembly has been connected with the new, now-running roll and is ready to control the further operation of that new, now-running roll.

The flying paster of the present invention achieves, in significant part, physical simplicity from its utilization of sophisticated drive software programs to control the brake accelerator assemblies. While other flying pasters have used core acceleration techniques, the present paster is the first, it is believed, to achieve speed matching by the use of a simple three-phase AC motor drive technology.

The physical simplicity of this flying paster offers another, commercially significant advantage. In its stackable version, the flying paster of the present invention can be stacked up to four high in the same space needed to accommodate three stacked, competitive flying pasters.

As a part of the simplicity of the splice preparation, a first strip of high-tack, low-tack adhesive may be applied, either to the undersurface of the leading edge of the leading end or to the new roll surface, one wrap back from the leading edge of the new roll. This first adhesive strip is applied so that it is slightly back from the leading edge, with the low tack side against the body of the roll. Thereafter, the leading end is squarely and tightly wrapped about the body of the new roll and the high-tack, low-tack strip alone holds the leading end securely to the new roll until the splice is made. The use of this high-tack, low-tack adhesive strip assures that the strip will pass through the press with the splice, not one wrap back from the splice which would cause additional waste.

A second transfer adhesive strip or tape is applied to the outer surface of the leading end so as to overlie the high-tack, low-tack adhesive strip and extends across the full width of the leading edge of the leading end of the new roll. This second strip is disposed close to but does not overlap the leading edge.

After the new roll has thus been prepared for splicing, the new roll may be loaded into the flying paster of the present invention. It is there positioned in a splicing position, and the ends of its center core shaft are connected with the movable brake and roll accelerator assembly. The new roll may then be accelerated such that the paster control circuitry can determine the diameter of the new roll, the weight of the new roll, the angle between a predetermined brake impulse and an optically scannable mark, which was made on the new roll during roll splice preparations, the frictional forces involved in the paster and the efficiency of the movable brake and roll accelerator assembly. During this mode, a relatively small encoder wheel is brought into contact with the outer peripheral surface of the new roll. After these electronic determinations have been made, the new roll may then be brought to a stop until it is time for that splice to occur.

At the time of the splice, a splicing assembly is used to position the running web adjacent to the outer peripheral surface of the new roll. The movable brake and roll accelerator is actuated to bring the new roll up to a speed which matches the speed of the running web. A set of brushes moves the running web into surface-to-surface contact with the outer peripheral surface of the new web and holds this contact, over substantially an entire revolution of the new roll, so as to give the surfaces time to stabilize. As the transfer tape, which is adhered to the leading end of the new roll, passes beneath the splicing assembly, a knife sub-assembly is actuated and cuts the old web. With the cutting of the web, a splice is achieved.

Prior to the splice, the old web is being withdrawn or unwound from a second roll, which is disposed in an operating or running roll position in the flying paster. The center core shaft of this second roll is connected with the fixed brake and brake accelerator assembly. Signals from the inertia-compensated-dancer control, through the paster control circuitry, this fixed assembly so as to maintain the running web under positive tension control at all times.

As soon as the splice has occurred, input signals from the inertia compensated dancer are employed, through the control circuitry, to control the moveable brake and roll accelerator assembly which is connected with the new, now-running roll. Thereafter, the center core shaft of the second roll is disconnected from the fixed brake and brake accelerator assembly, and the remainder of the second roll, including its center core shaft, is moved from the operating position to a discharge chute. The new, now-running roll, together with the movable brake and roll accelerator assembly, is then moved from the splicing position to the operating position. Once the new, now-running roll is at that latter position, the fixed brake and brake accelerator assembly is accelerated up to a matching speed and is then connected with an end of the center core shaft of the new, now-running roll. After the new roll and the fixed assembly have been connected, the new roll's center core shaft is disconnected from the moveable brake and roll accelerator assembly, and that moveable assembly is returned to its position adjacent the splicing position so as to be ready for the next new roll.

Accordingly, it is a primary object of the present invention to provide an improved flying paster, as described, that overcomes traditional flying paster problems and that presents a genuine, practical alternative to zero speed splicers.

Another object of the present invention is to provide a novel method of preparing a new roll for splicing by the utilization of a high-tack, low-tack adhesive strip, together with a transfer adhesive strip, where the high-tack, low-tack strip is used to hold the leading end of the new roll to the remaining body of the new roll during speed matching prior to the splice and where the transfer strip is used to adhere the leading end of the new roll to the trailing end of the running web at the splice. A related object of the present invention is to provide an improved method for preparing the new roll for splicing as described wherein the diameter of the new roll; the weight of the new roll; the angle between a predetermined brake impulse, which is imposed on the new roll by the moveable brake and roll accelerator assembly, and a color mark made on the outer periphery of the new roll adjacent to the leading edge during roll preparation; the frictional forces involved; and the efficiency of the moveable brake and roll accelerator assembly is determined during initial rotation of the new roll.

Still another object of the present invention is to provide an improved flying paster, as described, which has a exceedingly simple, straightforward design, vis-a-vis competitive, commercially available flying pasters, which uses novel core drive technology, and which maintains positive tension control at all times on the running web.

These and other objects, advantages and benefits of the present invention will become more apparent from the following detailed description of the preferred embodiment of the present invention that may be best understood with reference to the accompanying drawings.

DESCRIPTION OF THE DRAWINGS

The various figures of the drawings are as follows:

FIG. **1** is a partial, longitudinal, operator side, vertical cross-sectional view of a flying paster embodying the present invention;

FIG. **2** is a partial, left end or roll entry end, elevational view of the flying paster of FIG. **1**, with the web rolls removed from the paster;

FIG. **3** is a partial, enlarged cross-sectional view taken along the line **3—3** in FIG. **2**, and with a new roll being partially shown mounted in the flying paster.

FIG. **4** is a partial, enlarged cross-sectional view taken along the line **4—4** in FIG. **2**, and with a new roll being shown mounted in the flying paster.

FIG. **5** is a partial, cross-sectional view, similar to that shown in FIG. **4**, showing the running web being pressed against the peripheral surface of the new roll;

FIG. **6** is a partial, cross-sectional view, similar to that shown in FIGS. **4** and **5**, showing the running web being cut during the splicing operation;

FIG. **7** is a partial, operator side, vertical cross-sectional, view showing the core shaft mounting assembly for the running roll when it is disposed in its operating position;

FIG. **8** is a partial, cross-sectional view taken along the line **8—8** of FIG. **7**;

FIG. **9** is a partial, cross-sectional view taken along the line **9—9** in FIG. **8**;

FIG. **10** is a partial, cross-sectional view, similar to that shown in FIG. **7**, but showing the core shaft mounting assembly for the gear side end of the center core shaft of the running roll;

FIG. **11** is a longitudinal, gear side, elevational view of the flying paster of FIG. **2** showing the movable brake and the roll accelerator assembly in its position adjacent to the splicing position of the new roll;

FIG. **12** is a partial, cross-sectional view taken along the line **12—12** in FIG. **11**;

FIG. **13** is a partial, cross-sectional view taken along line **13—13** in FIG. **11**;

FIG. **14** is a partial, operator side, elevational view of the flying paster of FIG. **2**, showing the fixed brake and brake accelerator assembly; and

FIG. **15** is a partial, cross-sectional view taken along the line **15—15** in FIG. **14**.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The preferred embodiment of the flying paster in the present invention is illustrated generally at **22**. With particular reference to FIG. **2**, the flying paster **22** has a gear side or left side wall **24** and an operator side or right, side wall **26**. These vertically disposed walls **24** and **26** are spaced apart and are substantially parallel so that they have interior or inner-facing surfaces **25** and exterior or outward-facing surfaces **27**. The walls **24** and **26** are supported by a plurality of transverse support members, some of which are generally indicated at **29**. The upper and lower ends of the walls are designed so that, the paster **22** can be vertically stacked with other similar pasters if so desired. The spacing between the facing surfaces **25** of these side walls **24** and **26** is sufficient so that conventional rolls of web material, as for example, paper, may be mounted therebetween for rotation during which web material may be unwound from one of the rolls.

As best shown in FIG. **1**, a new roll of web material **28** is disposed in a splicing position adjacent to the entry end **30** of the paster **22**. Similarly, a second or running roll **32** is disposed in its operating or running roll position adjacent to the exit end **34** of the paster. The rolls **28** and **32** are mounted on steel center core shafts **36** and **38**, respectively. These shafts are of conventional design and construction except as otherwise noted hereinbelow. Both ends of each of the shafts **36** and **38** include pin receiving notches **40** (see FIG. **8**) so as to enable them to receive a driving pin as hereinafter described. For now, suffice it to say that the center core shaft **36** is adapted to be connected, at its gear side end, with a moveable brake and roll accelerator assembly **42**. Similarly, the operator side ends of the center core shafts **36** and **38** are adapted to be connected with a fixed brake and brake accelerator assembly **44**.

Prior to being loaded in the paster **22**, the new roll **28** should be prepared for a splice. In this regard, the leading edge of the leading end of the new web (that is, the web wound about the new roll **28**) should be trimmed square. A single strip of one-half inch wide conventional high-tack, low-tack adhesive is applied, either to the leading edge or to the roll surface one roll wrap back from the leading edge. A high-tack, low-tack adhesive strip, which is preferred, is one marketed by the 3-M Company of St. Paul, Minn. (3M Industrial Specialties Division) product No. 928-100.

One splice preparation sequence, which is simple and effective, is tearing the leading end of the new web using a carpenter's square so as to assure that the web leading edge is straight across its entire width. The leading end of the web is then folded back and a full web width (from side to side) strip of the high-tack, low-tack adhesive is positioned on it, one-eighth of an inch to three-sixteenths of an inch back from the leading edge, with the high-tack side face down, that is, in contact with the inwardly facing surface of the leading end. The leading end of the web of the new roll is then folded back so that the low-tack side of the high-tack, low-tack adhesive strip securely holds the leading edge to the outer peripheral surface of the body of the roll **28**. This assures that the high-tack, low-tack adhesive strip will pass through the press with the splice, and not one wrap back from the splice which would cause additional web wastage. Care should be taken that the outer wraps of the roll are lined up with the side edges of the roll and are pulled taut and square.

A conventional strip of regular, one-inch wide transfer adhesive is then applied across the full width (that is, from side to side) of the new roll as close to but not overlapping, the leading edge as possible. A suitable transfer tape is marketed by North Shore Consultants, Inc. of Chicago, Ill., Tape No. 3765. The backing is removed from the tape, although as with zero-speed splicing, it may be desirable, in dusty environments, not to remove the backing until near the time for a splice.

A conventional black marker pen is used to make a mark or line immediately behind the strip of transfer adhesive. The black mark or line should be made so that it is aligned with an encoder wheel **46**, which is part of the paster's splice assembly **48**, when the new roll is disposed in the splicing position in the paster **22**, as hereinafter described. This black mark is to be tracked by a conventional optical sensor, not shown, mounted on and carried by the encoder wheel **46**.

After the new roll **28** has thus been prepared for splicing, it is loaded, by a means of a conventional hoist, not shown, into the paster **22**. The hoist may be an integral part of the paster **22** or may be a separate piece of equipment. The hoist will pick up the new roll by the ends of its shaft **36** and place it sufficiently near or at the splicing position so that the shaft **36** may be connected with the moveable brake and roll acceleration assembly **42**.

After the new roll **28** is loaded in the flying paster **22**, the paster operator may cause the roll **28** to be moved to its final splicing position. As generally shown in FIGS. **12** and **13**, a spring biased brake spindle or coupling member **52** of the moveable assembly **42** is caused to be extended so as to be connected with the notched gear side end of the shaft **36**. (Specifically a transverse connection pin **53** carried at the distal end of the spindle **52** will engage the notches **40**.) An accelerator motor **54**, which is part of the assembly **42**, is also actuated. This assures that the pin **53** of the spindle **52** properly seats in the notched adjacent end of the core shaft **36** and results in a slow rotation of the new roll **28**. As this rotation occurs, the roll **28** is moved forward, toward the end **34**, until the roll surface breaks a cross-paster positioning beam, not shown. Once this beam is broken by the roll surface, the roll **28** is inched back toward the end **30**, until no point around the circumference of the new roll **28** cuts the beam. Finally, the roll **28** is "kicked" forward to remove any backlash in the roll. The accelerator motor **54** is then shut off and the assembly **42** stops the rotating new roll **28**. Roll **28** remains stationary in the splicing position until the splice assembly **48** is lowered from its retracted position, shown to its extended position, shown in FIGS. **2-6**. In this latter position, the assembly **48** is positioned adjacent to the outer peripheral surface of the new roll, as best illustrated in FIGS. **3-6**.

Referring now to FIGS. **2** and **3**, the splice assembly **48** includes two side arms **58** and **62** disposed adjacent to the facing surfaces **25** of the side walls **24** and **26**, respectively. These arms are mounted for pivotal movement on and about a cross rod **64** that extends between the side walls **24** and **26**. Each of the distal ends of the arms **58** and **62** include a bracket **66** that is perpendicularly disposed, with respect to the longitudinal axis of its arm, and that projects generally toward the end **30** when the assembly is in its extended position.

A lower idler roller 68 is supported for rotation by the distal ends of the arms 58 and 62. An upper idler roller 72 is similarly supported, at its ends, by the arms 58 and 62, intermediate the ends of the arms 58 and 62. The running web 74 (that is, the web running from the second roll 32) passes about the lower idler roller 68 and then about the upper idler roller 72, as best seen in FIGS. 4–6, so that a portion of the running web passes closely adjacent to a portion of the outer peripheral surface of the new roll 28 when the splice assembly 48 is in its extended position.

Conventional double acting fluid cylinders 76 and 78 cause the splice assembly 48 to be lifted between its retracted or upper position and its extended or lower position. The lift cylinders 76 and 78 are mounted on brackets attached to the side walls 24 and 26 and have their rod ends connected with the arms 58 and 62, respectively.

As noted, the splice assembly 48 also includes the encoder wheel 46. It is mounted at one end of an encoder arm 82. The other end of the arm 82 is mounted on a transverse rod 85 that extends substantially between but is not supported by the arms 58 and 62. The encoder arm 82, and thus the encoder wheel 46, may be pivoted between a first or retracted position where the encoder wheel lies in a plane of the arms 58 and 62 and a second or extended position where the encoder wheel 46 gently rides on the outer peripheral surface of the new roll, as shown in FIG. 3. Actuation of a pair of conventional, double acting fluid cylinders 83 causes the pivotal movement of the encoder wheel 46 between its first and second positions. The rod ends of the encoder cylinders 83 are connected with and support the ends of the encoder rod 85. The other ends of the cylinders 83 are mounted on members that extend laterally from the distal ends of the brackets 66.

The encoder wheel 46 is of conventional design, has a relatively narrow cross-sectional width, particularly when compared with the overall width of the new roll 28, so that its contact with the new roll does not unduly disturb the fibers of the web of the new roll. Mounted adjacent to the encoder wheel is a conventional optical scanner, which as noted above is not shown, for sensing the passage of the black mark or line which is applied to the outer surface of the leading end of the new roll during roll splice preparation.

A brush subassembly including a set of brushes 84, two which are shown, extends from side to side across the new roll 28. The brushes are mounted in a brush carrying bracket 86. This bracket is pivotally mounted on and about a rod 85 extending between the arms 58 and 62 and may be moved from a first position, within the plane of the arms, as shown in FIG. 4, to a second position where the brushes' bristles force the portion of the running web 74 (which is running between the lower and upper idler rollers 68 and 72) against the outer peripheral surface of the new roll 28. Actuation of a conventional, double acting fluid cylinder 88 causes the pivotal movement of the brush bracket 86, and thus the brushes 84, between their first and second positions. This brush cylinder 88 extends between the brush bracket 86 and lateral member carried by the arm 62.

The splice assembly 48 also includes a knife subassembly including a knife 92 that is adapted to cut the running web 74 at the time of a splice. The transverse dimension of the knife 92 is greater than the width of the running web 74. The knife 92 is supported by a knife holding bracket 94 that is pivotally mounted on and about the operator side stub shaft 95 of the lower idler roller 68 and between the roller 68 and the arm 62. This knife holder bracket 94 may be moved between a first position where the knife 92 is disposed between the plane of the arms 58 and 62 and a second position wherein it extends beyond this plane, toward the new roll, so as to cut the web 74 running between the lower and upper rollers 68 and 72. Actuation of a conventional, double acting fluid cylinder 96 moves the knife holder bracket 94 between its first and second positions. The knife cylinder 96 extends from lateral member attached to the bracket 94 and a lateral member attached to the arm 58.

As noted above, in a method unique to the flying paster 22, important information about the new roll 28 and the running condition of the paster is collected and determined prior to splicing. This may begin when the splice assembly 48 is lowered to its extended position by actuation of the cylinders 76 and 78. Normally, the paster control circuitry causes this to automatically occur when the running roll 32 reaches a predetermined, sensed diameter. After the splice assembly is thus lowered, the encoder wheel 46 is moved, by actuation of the encoder cylinders 83, into a gentle surface-to-surface contact with the outer peripheral surface of the new roll. The moveable assembly 42 is then actuated so that the accelerator motor 54 again begins rotating the new roll 28. Using the known torque of the accelerator motor 54, a periodic (that is, once per revolution) probe pulse from the assembly 42, the encoder information, and the signal from the leading edge sensor (that is, the sensing of the black mark behind the second or transfer strip), the paster control circuitry can determine the new roll's diameter, the roll's weight, and the angle between the brake pulse and the leading edge of the web.

Following this acceleration of the roll 28, there is a period of time when the accelerator motor 54 is turned off, and the new roll 28 is allowed to coast. This permits a determination of the system friction. Finally, the brake of the assembly 42 is applied with a known pressure, and its efficiency is measured. Not only does this acceleration and coast provide important information about the new roll 28, it also monitors the condition of the paster 22 so as to permit automatic adjustments for normal wear and tear.

Thereafter, the encoder wheel 46 is moved away from its surface-to-surface contact with the new roll to its retracted position. The encoder wheel is normally not used again during a paster cycle. It could, however, be used to provide speed matching information if low speed splicing were desired.

A second, conventional encoder, not shown, is mounted on one of the exit idler rollers 98 in the paster adjacent to its exit end 34. This second encoder is used to provide running web speed information to the paster control circuitry.

The paster control circuitry can calculate when speed matching can begin using the control signal from the second encoder, the operator—set roll—32 splice diameter (that is, the diameter of the roll 32 at which splicing is to begin), and the information determined during the initial acceleration. Because nothing is touching the outside surface of the new roll 28 during this time period, there is no reason or need to have the roll 28 accelerated rapidly to a match speed. This allows the use of small (that is, a one horsepower) accelerator motor 54 in the roll acceleration phase.

When a speed match occurs (that is, when the speed of the new roll **28** matches the speed of the running web **74**), and the running roll **32** reaches its pre-set splice diameter, the splicing operation may commence. The specific timing of the splice is made with reference to the periodic brake pulse signal and its previously measured angle with the leading edge of the new roll. This information determines the time of firing of the brushes **84** (that is, moving the brushes **84** from their retracted position shown in FIG. **4** to their extended position shown in FIG. **5**) so that they press the running web **74** against the surface of the new roll immediately after the leading edge has passed underneath the brushes. This provides almost one full revolution of the new roll during which contact occurs between the two webs. This web-to-web contact, tends to stabilize them with each other before the running web contacts at the second or transfer adhesive strip.

The known position of the leading edge is used to "fire" the knife **92** (that is, pivot the knife between its FIG. **5** retracted position and its FIG. **6** extended position) so that the knife cuts or severs the running web **74**. The parameters controlling the timing of the firing of the knife **92** are determined by the paster control circuitry to control the length of the spliced "tail", so that it remains constant regardless of the speed of the old running web **74**.

Up until the time of the actual splice, the second running roll **32** is operating under the control of the fixed brake and brake acceleration assembly **44**. The operation of this assembly **44** is, in turn, controlled by a signal received from a conventional dancer **102** in the sense that the dancer **102** includes the second encoder mentioned above. This dancer is disposed at the exit end **34** of the paster **22**, and the running web **74** passes through it as the web exits from the paster. The dancer **102** is a single roller, inertia compensated, pneumatically loaded linear dancer. The dancer control signal is switched, by the paster control circuitry, from the assembly **44** to the assembly **42** at the time of the splice. The use of this dancer control signal to control the assembly **44**—while the web **74** is unwinding from the second roll **32**—and to control the assembly **42**—after the splice—assures that the unwinding roll, regardless of whether it is roll **28** or roll **32**, is under positive tension control at all times.

After a splice has been made, the paster control circuitry causes the fixed assembly **44** to be disconnected from the center core shaft **38** of the expired second roll **32**. The splice assembly **48** is also lifted to its retracted or parked position as shown in FIG. **1**.

A roll-transfer drive assembly **104** is then switched on, by the paster control circuitry, so as to move both rolls **28** and **32** forward toward the exit end **34** of the paster **22**. As a result, the expired roll **32**, or more particularly, the center core shaft **38** and whatever web material still remains wound about it, drops or slides down a ramp **105** and into a removal trough **106** as hereinafter explained in more detail. The new, now-running roll **28** continues to move forward until it reaches the operating position and is aligned with the fixed brake assembly **44**, more particularly with the brake output spindle **108** of that assembly **44**.

The fixed brake assembly **44** is then accelerated so that the speed of the spindle **108** matches the speed of the new, now-running roll **32**. At this point, the paster control circuitry causes the fixed brake and brake accelerator assembly's spring loaded brake connection (as hereinafter described) to connect the assembly **44** with the notched, operator side end of the center core shaft **36**. Thereupon, the control signal from the dancer **102** is again switched, by the paster control circuitry, from the assembly **42** to the assembly **44** and thereafter used to control the operation of the assembly **44**. (And the dancer signal ceases to control the operation of the moving assembly **42**.) The paster control circuitry causes the moving assembly **42** to be disconnected from the gear side end of the shaft **36** by the retraction of the spring loaded spindle **52**. Then the assembly **42** is moved back, adjacent to the splicing position, near the entry end **30** of the paster **22**, to await the positioning of the next new roll.

As best shown in FIGS. **11–13**, the moveable brake and roll accelerator assembly **42** includes, as noted above, the conventional AC electric motor **54** that drives or rotates, via a "V" belt **114**, a conventional single brake disc **116**. The centrally disposed brake spindle **52** projects through an elongated opening **122** in the side wall **24**. The brake disc **116** and spindle **52** are mounted for rotation on a conventional brake hub assembly **124**. The distal end of the spindle **52**, as noted above, projects into the interior space between the side walls **24** and **26**. It includes a transverse drive pin **53** which is adapted to engage the notches **40** in the adjacent, gear side end of the center core shaft **36** of a new roll **28**.

The distal end of the spindle **52** is adapted to be, as noted above, moved between a first or projected position, where the drive pin **53** may engage the notches **40**, and a second or retracted position where the distal end does not project far enough into that interior space so that the pin **53** does not engage the notches **40**. The brake hub **124** includes a central recess. A coil compression spring **132** is disposed within that recess and biases the spindle **52** to its projected position.

The actuation of a conventional, double acting fluid cylinder **134** causes the spindle **52** to move between its retracted and projected positions. The cylinder **134** is mounted on a bracket **136**. The rod end of the cylinder **134** is connected with one end of an elongated arm **138**, which is pivoted, intermediate its ends, on the outward-facing end of the bracket **136**. The other end of the arm **138** is connected with the outward-facing end **140** of the spindle **52**. Thus, actuation of the cylinder **134** causes the arm **138** to pivot, and this, in turn, causes the spindle **52** to move between its retracted and projected positions.

The end **140** of the spindle **52** is fixed to a cross member **142** whose outer ends are supported by conventional Thomson linear bearings **144**. These bearings **144** are, in turn, supported on the outside surface of the brake disc **116** and project perpendicularly outwardly from the face of the brake disc. The bearings **144** guide and facilitate the movement of the spindle **52** with respect to the brake disc **116** and brake hub **124**.

A conventional, double caliber brake mechanism **146** is mounted adjacent to the peripheral edge of the brake disc **116** and diametrically opposite from the motor **54**. The mechanism **146** functions, in a conventional manner, to brake the rotation of the disc **116**, the spindle **52** and thus the new roll **28**. Its operation is controlled by the paster control circuity as described herein.

The mechanism **146** is mounted on a wall of a box-like structure **148** in a conventional manner. The other components of the assembly **42** are also mounted, in a conventional manner, on this structure **148**.

A plurality of Thomson bearings **152** are used to support the lower end of the structure **148** on a conventional Thomson linear bearing rod **154** so that the structure **148** (and thus the assembly **142**) may slide and be carried along the bearing rod **154**. The rod **154** is mounted on brackets **155** on the side wall **24** and adjacent to the outwardly facing surface of that wall. The length of the rod **154** is selected so that it is longer than the distance between the splicing position and operating position of the rolls **28** and **32**. The longitudinal axis of the rod **154** is parallel to the plane of the adjacent side wall **24**.

The side wall opening **122** is, as noted, elongated and its longitudinal axis is parallel to the longitudinal axis of the rod **154**. Like the rod **154**, the length of this opening **122** is longer than the distance between the rolls' splicing and operating positions so that its one end, adjacent to the entry end **30**, overlies the splicing position while its other end, adjacent to the exit end **34**, overlies the operating position.

To facilitate movement of the structure **148**, and thus the assembly **42**, along the rod **154**, a pair of bearing rollers **156** cooperate with the depending leg of a L-shaped flange **158**. The other leg of the L-shaped flange **158** is secured to the side wall **24**. The bearing rollers **156** are mounted for rotation on the upper surface of the structure **148**.

The roll-transfer drive assembly **104** includes a carriage assembly **162** which is best shown in FIG. **11**. The assembly **162** is utilized to move the structure **148** and thus the movable assembly **42** between its first position, adjacent to the splicing position of the new roll, and its second position, adjacent to the operating position of the running roll. This assembly **162** comprises an endless chain **164** and a plurality of drive and idler sprockets, two of which are shown at **166** in FIG. **11**. A carrier **168** is secured, at its lower end, to the chain **164**. The upper end of the carrier **168** is connected with the lower end of the structure **148**. A conventional electric motor **170**, as shown in FIG. **14**, is connected, via a chain drive, with the sprocketed end of a cross-paster timing and drive shaft **172**. The motor **170** is utilized to drive the chain **164**, and the chain **164**, in turn, moves the structure **148**, and thus the assembly **42**, in a conventional manner along the Thomson rod **154**.

Referring particularly to FIGS. **1**, **8** and **9**, each end of shaft **36** is supported for rotation by a shaft carrier **174**. Each of these carriers is structurally and functionally the same, and hence, only one will be described in detail. More specifically, each of the carriers **174** has a plurality of roller bearings **176** mounted adjacent to its lower end. They cooperate with and roll along an elongated guide **178** that is supported by brackets **180** attached to the side wall, as shown in FIGS. **2** and **8**. The guides **178** are parallel to the longitudinal axis of the rod **154**, and extend along the side walls from near the entry end **30** to near the exit end **34** of the paster **22**.

Each of the carriers **174** has, adjacent to its upper end, two spaced apart, side-by-side rollers **184**. These rollers **184** are mounted for rotation about their axes which are perpendicular to the axis of its associated guide **178** and parallel to the longitudinal axis of the shaft **36**.

Grooves **185** are machined adjacent to each end of the center core shafts and are spaced, along their axes, so that the grooves **185** are aligned with the carriers **174**, and more particularly, with the rollers **184** mounted on the carriers **174**. Each of the rollers **184** has a width that will let them be received in and ride in a groove **185** as shown in FIGS. **8** and **9**.

A pair of rollers **184** is mounted, side by side, in a support bracket **186**. The two rollers **184** are spaced a distance apart in a bracket **186** such that the center core shaft **36** can be sit therebetween as illustrated in FIG. **8**.

The support bracket **186** and the rollers **184** are maintained in its horizontal position during the time that the rollers support the shaft **36**. They are moved to a substantially vertical position after the roll **28** arrives at the operating position. For this reason, one end **187** of each bracket **186** is pivotally connected with its associated carrier **174** such that the rollers can be moved from their horizontal position to a generally vertical position, as shown generally in FIG. **9**, where the rollers are no longer disposed within the groove **185**. The movement of the bracket **186** between its horizontal and vertical positions is controlled by a conventional double-acting fluid cylinder, not shown, which is actuated by the paster control circuitry.

The roll-transfer drive assembly **104** also includes a pair of endless chains **189**, one of which is shown in FIG. **1**. These chains **189** extend from adjacent the entry end **30** to adjacent the exit end **34** of the paster **22** and are disposed near the side walls **24** and **26**. They are connected with and driven by the drive shaft **172** and thus the motor **170**. A plurality of drive and idler sprockets **190** support the chains **189**. Each chain **189** is connected with its adjacent carrier **174** and serves to move that carrier, and the shaft **36**, between the splicing and operating positions. Since chains **164** and **189** are "tied" together by the shaft **172**, the carriers **174** and the structure **184** (and the assembly **42**) are always moved together.

The ends of the center core shaft **38** are similarly mounted for rotation in the paster **22**. Specifically, each end of the shafts **38** is supported by a fixed core shaft holder assembly **191** that is mounted on the paster near the inside-facing surfaces of the side walls **24** and **26**. Each assembly **191** includes a housing **192** supported on the side wall and located between the side wall and the adjacent guide **178**. The assemblies **191** are structurally and functionally similar. Accordingly, only the assembly **191**, adjacent the operator side (as shown in FIGS. **7** and **8**), will be described in detail, and the same reference numbers will be used for the same components in the assembly **191** (see FIG. **10**) mounted on the gear side of the paster.

More specifically, a pair of spaced apart, side-by-side rollers **193** are mounted for rotation in a support bracket **194** in the assembly **191**. The axes of the rollers **193** are parallel to each other and to the axes of the center core shafts. Like the rollers **184**, the rollers **193** are normally disposed horizontally and are spaced apart sufficiently that the shaft **38** (or at times, the shaft **36**) may be supported for rotation therebetween as shown in FIG. **7**.

To assist in assuring that the shaft **38** stays supported on the rollers **193**, during the unwinding of the roll **32**, a stationary roller **210** is mounted above the shaft **38** and the rollers **193** at each end of the shaft **38**. These rollers **210** are mounted for rotation on a flange **212** that is connected with the adjacent side wall.

The end **195** of the bracket **194**, which is adjacent to the entry end **30**, is pivotally connected with the housing **192** so that the bracket, and thus the rollers **193**, can be moved between their normal horizontal position and a substantially vertical position. As best illustrated in FIGS. **7** and **8**, the bracket **194** is supported in its horizontal position by an over-the-center toggle sub-assembly **196**. This sub-assembly comprises a first pair of spaced apart members **198** which are connected, at their one ends, with the bracket **194** near its midsection, as viewed in FIG. 7. The other ends of this first pair of members **198** are pivotally connected with the one ends of a second pair of members **202**. These second members **202** are, in turn, connected at their other ends with a cross shaft **204**. One end of an actuator arm **206** is secured to the shaft **204** adjacent its midpoint. The other end of the arm **206** is connected with the rod end of a conventional double acting fluid cylinder **208** which, in turn, is supported at its other end by the paster **22**. The operation of the cylinder **208** is controlled by the paster control circuitry.

A threaded bolt **214** extends through a thread bore in a member **216** that is secured to the side wall. A projecting end of the bolt **214** is disposed adjacent to the joined ends of the first and second members **198** and **202** when they are in their upright positions, as shown in FIGS. **7** and **8**, and serves to limit the degree that these joined ends can rotate toward the exit end **34**. A threaded nut **218** permits an adjustment of the length of the projecting end of the bolt **214**.

Starting from the positions shown in FIGS. **7** and **8**, retraction of the cylinder **208** causes a counter-clockwise (as shown in FIG. 7) rotation of the cross shaft **204** and thus the members **202**. Such counter-clockwise rotation of the second members **202**, causes the bracket **194** to pivot downwardly, about the end **195**, so that the rollers **193** are moved to their generally vertical position. When the rollers **193** are so moved, the shaft **38** may then slide or drop forward out from between the rollers **193** and down the incline ramp **105**. As noted above, the discharge shoot **106** is at the exit end of the ramp **105** and serves to catch and hold the shaft **38** for later removal from the paster.

After the shaft **38** has been thus removed from the operating position, the roll transfer drive assembly **104** moves the shaft **36**, and the accompanying new roll **28**, to the operating position. Thereafter, the cylinder **208** is extended so that the members **198** and **202** are returned to their vertical positions, as shown in FIG. 7, so that the bracket **194** and the rollers **193** resume their horizontal position and so that the rollers **193** support the ends of the shaft **36**.

After the shaft **36** is supported by the rollers **193**, the paster control circuitry actuates the cylinders associated with the brackets **186** so as to move the brackets and the rollers **186** from their horizontal position to their vertical positions. When the brackets **186** are thus moved, the rollers **184** no longer support or contact the shaft **36** and the carriers **174** (as well as the assembly **42**) are ready to be moved from the operating position to the splicing position.

The fixed brake and brake accelerator assembly **44**, as shown in FIGS. **14** and **15**, is mounted on the operator side, side wall **26** and includes a conventional AC brake accelerator electric motor **224**. As noted above, the horsepower of this motor **224** may be quite small, as for example, one horsepower, because in the paster **22**, a delay in accelerating the assembly **44** up to web running speed does not present a problem due to the fact that during this acceleration, the running web is always under the control of the movable assembly **42**.

The assembly **44** also includes a conventional brake disc **226** which has been modified by machining a plurality of conventional spur gear teeth **228** about its outer peripheral edge. These teeth **228** are adapted to mesh with a spur gear **232** mounted on and rotated by the output shaft of the motor **224**. A conventional double caliber brake mechanism **234** is mounted adjacent to the side peripheral edge of the brake disc **226**. The brake disc **226** is mounted on a conventional brake hub **236** which is substantially identical to the hub **124**. As noted above, the spindle **108**, like the spindle **52**, rotates with the brake disc **226** and may additionally be moved, in a direction parallel to its longitudinal axis, between a retracted position and an extended position.

A sub-assembly **240** which causes such longitudinal movement of the spindle **108** is similar in construction and operation to that used to move the spindle **52**. For that reason, a further description of this sub-assembly **240** is not believed to be needed and similar reference numerals have been used to identify the similar parts.

The distal end **242** of the spindle **108** projects through a circular opening **244** in the side wall **26**. The distal end **242** has a drive pin which is adapted to fit in the notches **40** in the ends of the shafts **36** or **38**. Like the spindle **52**, the spindle **108** is biased by a coil compression spring **246** to its extended position. The distal end **242** of the spindle **108** may also include an annular collar member **248** which is likewise spring biased away from the hub **236** by a coil compression spring **252**. The collar facilitates connecting the distal end **242** with the notched ends of the shafts.

The paster control circuitry includes a Motorola microcontroller chip, identified by the Motorola No. 68 HC 11 D 3, and manufactured by the Motorola Corporation of Schaumburg, Ill. This chip is used with a printed circuit board having conventional components. The following copyrighted programs (that is, the RTX/PLC program HEX file, application program HEX file, and ladder program HEX file and PLC interpreter source code file) are used by the paster control circuitry to control the paster **22**:

RTX/PLC Program

HEX file

```
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Ladder Program H‹ File

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PLC Interpreter Source Code

```
; some constants
ll_frs  equ 512   ; framesize
ll_nb equ 512   ; number of bits total
ll_nry  equ 256   ; number of relays
ll_ntc  equ 128   ; number of variables
ll_nio  equ 48    ; number of ios
; ladder static variables
lv_data equ 00
lv_bits equ lv_data
lv_rlys equ lv_bits   ; relay bits
lv_tcds equ lv_rlys+ll_nry/8  ; tc done bits
lv_tcrs equ lv_tcds+ll_ntc/16 ; tc rung bits
lv_ios  equ lv_tcrs+ll_ntc/16 ; io/system bits
lv_free equ lv_ios+ll_nio/8 ; unused bits
lv_work equ lv_bits+ll_nb/8 ; scratch space for interpreter
lv_sign equ lv_work ; signal
lv_acc  equ lv_work+1 ; accumulator
lv_c01  equ lv_work+3 ; .01s clock
lv_t01  equ lv_work+4 ; .01s ticker
lv_p10  equ lv_work+5 ; .10s partial
lv_t10  equ lv_work+6 ; .10s ticker
lv_bump equ lv_work+7 ; can be tick or count
lv_temp equ lv_work+8 ; 4b for scratch
lv_eow  equ lv_work+12  ; end of work space
lv_cnts equ lv_eow    ; words of tcv counters
lv_eof  equ lv_cnts+ll_ntc*2  ; end of frame
lv_end  equ lv_data+ll_frs
lv_size equ lv_end-lv_data
lv_chk  equ lv_size-lv_eof

ll_io1  equ mm_io1  ; bases for ios
ll_io2  equ mm_io2
ll_pa equ mm_iopa ; port a data
ll_pac  equ mm_ioca ; port a control
ll_pb equ mm_iopb ; port b data
ll_pbc  equ mm_iocb ; port b control
ll_ddb  equ $04   ; dd control bit

lp_plen equ 0   ; length of prefix
lp_conf equ 4   ; config bits

; use output compare timer for .01 s increments
plc_tick equ #20000 ; 20K e is .010 s
plc_ticker
  ldd #plc_tick
  addd  ir_toc1
  std ir_toc1
  ldx PLC
  inc lv_c01,x
  bclr  ir_tflg1,$7f
  rti
; service routines
plcbit  subd  #$0001
```

```
  jmp lo_bit    ; addr, mask into y,b
plcvar  decb     ; addr in y
  clra       ; d is tc number
  asld       ; times two
  addd  #lv_cnts  ; plus offset
  addd  PLC    ; plus frame start
  xgdy
  rts
plcfor  ldx PLC    ; force outputs
  ldd lv_ios,x
  ldy lv_ios+2,x
  ldx #l1_io1    ; for pia 1
  staa  l1_pa,x
  stab  l1_pb,x
  xgdy
  ldx #l1_io2    ; for pia 2
  staa  l1_pa,x
  stab  l1_pb,x
  rts

; service routines
; main entry for task
plc_entry
;   allocate statics stack frame
  tsx      ; get starting stack address
  xgdx
  subd  #lv_size  ; adjust down for stack frame
  xgdx      ; maintain x as frame pointer
  stx PLC
; initialize static varibles
  ldy #lv_size+1
  clra
: staa  0,x
  inx
  dey
  bne :-1
  ldx PLC
  ldab  #$01    ; set mcr on
  stab  lv_ios+5,x  ; at bit 40
; start output compare ticker
  ldd #plc_ticker
  std rtxVectors+sv_to1
  bset  ir_tmsk1,mr_oc1i
  std ir_toc1
; initialize dd regs
  ldx applu    ; get config from prefix
  ldy apPLCBase,x
  ldaa  lp_plen,x
  bpl :+1    ; length>127 is invalid
  ldaa  #$31
  jmp flasher    ; code .. no ladder loaded
: ldd lp_conf,y ; a,b ddr
  ldx PLC
  std lv_ios,x  ; set all op hi
  ldx #l1_io1    ; pia 1
  bset  l1_pac,x,l1_ddb ; to data bits
  bset  l1_pbc,x,l1_ddb
  staa  l1_pa,x    ; for initial value
  stab  l1_pb,x
  bclr  l1_pac,x,l1_ddb ; then to dd bits
  bclr  l1_pbc,x,l1_ddb
```

```
  staa  ll_pa,x
  stab  ll_pb,x
  bset  ll_pac,x,ll_ddb ; now back to data
  bset  ll_pbc,x,ll_ddb
  ldd lp_conf+2,y
  ldx PLC
  std lv_ios+2,x  ; set all op hi
  ldx #ll_io2   ; now pia 2
  bset  ll_pac,x,ll_ddb
  bset  ll_pbc,x,ll_ddb
  staa  ll_pa,x
  stab  ll_pb,x
  bclr  ll_pac,x,ll_ddb
  bclr  ll_pbc,x,ll_ddb
  staa  ll_pa,x
  stab  ll_pb,x
  bset  ll_pac,x,ll_ddb
  bset  ll_pbc,x,ll_ddb
plc_set
; set hardware from out bits
  jsr plcfor
plc_top
; set in bits from hardware
  ldx #ll_io2   ; add ip bits
  ldaa  ll_pa,x
  ldab  ll_pb,x
  xgdy
  ldx #ll_io1
  ldaa  ll_pa,x
  ldab  ll_pb,x
  ldx PLC
  std lv_ios,x  ; in 01..16 for now
  sty lv_ios+2,x  ; in 17..32 for now
; set time tickers
  clrb
  sei
  ldaa  lv_c01,x  ; ticks since last scan
  stab  lv_c01,x
  cli
  staa  lv_t01,x  ; is .01 ticker
  adda  lv_p10,x  ; and part of .10 partial
: suba  #10   ; as long as partial has a full .10
  bcs :+1
  incb      ; then show in .10 ticker
  bra :-1
: adda  #10   ; then save rest in partial
  staa  lv_p10,x
  stab  lv_t10,x
  ldx applu   ; x is op pointer
  ldx apPLCBase,x ; start at beginning
  ldab  lp_plen,x ; length of prefix
  abx
plc_cycle
; stx temp
  ldd 0,x   ; next op
  bmi plc_set   ; >$7f is end of ladder
  bita  #$f0    ; $00..0f are one byte ops
  beq lo_1b
  bita  #$c0    ; $10..3f are two bytes
  beq lo_2b
  cmpa  #$70    ; $40..6f are three bytes
```

```
  bcs lo_3b
lo_4b ldy 2,x   ; get constant
  inx     ; bump to next op
  inx
  inx
  inx
  pshx      ; nextop is deepest
  pshy      ; data is next
  pshb      ; tc number on top
  ldx #j_4b   ; figure address of process
lo_go tab
  abx
  ldab  0,x
  abx
  jmp 0,x
lo_3b ldy 1,x   ; get whatever
  ldab  #3    ; bump to next op
  abx
  pshx      ; nextop is deepest
  pshy      ; data on top
  ldx #j_3b4    ; $4x ops
  bita  #$10
  beq lo_go
  ldx #j_3b5    ; $5x ops
  bra lo_go
lo_2b inx     ; bump to next op
  inx
  pshx      ; nextop is deepest
  cmpa  #$30    ; $3x is math t.b
  bcc lo_2b3
  jsr lo_bit    ; bit in d to addr, mask
  pshb      ; is mask, addr in y
  ldx #j_2b   ; figure address of process
  bra lo_go
lo_2b3  psha      ; stash op
  clra      ; d is tc number
  asld      ; times two
  addd  #lv_cnts  ; plus offset
  addd  PLC   ; plus frame start
  xgdy      ; leave in here for put
  pula      ; get op back
  adda  #$10    ; and make it into $4x
  ldx 0,y   ; get contents of tc
  pshx      ; to make it look like $4x
  ldx #j_3b4    ; $4x ops
  bra lo_go
lo_1b inx     ; bump to next op
  pshx
  ldx #j_1b   ; and go do it
  bra lo_go

; bit number in D, get addr and mask in y,b
lo_bit  pshb      ; 00oo oooa aaaa abbb
  lsrd      ; 000o oooo aaaa aabb
  lsrb      ; 000o oooo 0aaa aaab
  lsrb      ; 000o oooo 00aa aaaa
  ldy PLC   ; point y to byte
  aby
  pulb      ; get bit num back for mask
  andb  #$07
  ldx #lo_masks
```

```
  abx
  ldab  0,x
  rts
lo_masks db 1,2,4,8,16,32,64,128
; one byte ops:
;  stack is nextOp.w
j_1b  equ *
  db  le_push-*
  db  le_pullor-*
  db  le_push-*
  db  le_pulland-*
  db  le_time01-*
  db  le_time10-*
  db  le_countup-*
  db  le_mcr-*
  db  le_cmr-*
  db  le_btd-*
  db  le_dtb-*
  db  le_quad-*
le_push
  ldx PLC
  ldaa  lv_sign,x ; push current signal
  pulx
  psha
  jmp plc_cycle
le_pullor
  ldy PLC
  pulx
  pula       ; or saved signal
  oraa  lv_sign,y ; with current
  staa  lv_sign,y
  jmp plc_cycle
le_pulland
  ldy PLC
  pulx
  pula       ; and saved signal
  anda  lv_sign,y ; with current
  staa  lv_sign,y
  jmp plc_cycle
le_time01
  ldx PLC
  ldaa  lv_t01,x  ; is number of ticks
  bra le_tstb
le_time10
  ldx PLC
  ldaa  lv_t10,x  ; is number of ticks
le_tstb ldab  lv_sign,x ; if rung is true
  bitb  #$04
  bne le_setb   ; then save bump
  clra
le_setb staa  lv_bump,x
le_lx pulx      ; get nextop back
  jmp plc_cycle
le_countup
  ldx PLC
  ldaa  #$ff    ; is count true
  bra le_tstb
le_mcr
  ldab  #$01    ; mask for mcr
  pshb
  ldab  #5+lv_ios ; mcr is bit 40
  ldy PLC   ; point y to byte
  aby
```

```
   jmp le_enable
 le_cmr
   ldab  #5+lv_ios ; mcr is bit 40
   ldy PLC   ; point y to byte
   aby
   ldab  #$01    ; mask to set it
   jmp le_sbit
 le_btd
 le_dtb
 le_quad
 le_unimp
   ldaa  #$32
   jmp flasher   ; code .. unimplemented feature

 ; two byte ops:
 ;  stack is mask, nextOp.w, y^ is addr
 j_2b  equ *-$0008   ; op/2
   db  le_if-*
   db  le_ifnot-*
   db  le_and-*
   db  le_andnot-*
   db  le_or-*
   db  le_ornot-*
   db  le_enable-*
   db  le_latch-*
   db  le_unlatch-*
 le_if
   ldx PLC
   pula      ; mask
   anda  0,y   ; Z bit is not x
   tpa     ; put it in a2
   coma      ; set for straight if
   staa  lv_sign,x
   bra le_1x
 le_ifnot
   ldx PLC
   pula
   anda  0,y
   tpa
   staa  lv_sign,x
   bra le_2x
 le_and
   ldx PLC
   pula
   anda  0,y
   tpa
   coma
   anda  lv_sign,x
   staa  lv_sign,x
 le_2x bra le_1x
 le_andnot
   ldx PLC
   pula
   anda  0,y
   tpa
   anda  lv_sign,x
   staa  lv_sign,x
   bra le_2x
 le_or
   ldx PLC
```

```
  pula
  staa  0,y
  tpa
  coma
  oraa  lv_sign,x
  staa  lv_sign,x
  bra le_2x
le_ornot
  ldx PLC
  pula
  anda  0,y
  tpa
  oraa  lv_sign,x
  staa  lv_sign,x
  bra le_2x
le_enable
  pulb
  ldx PLC
  ldaa  lv_sign,x
  bita  #$04
  beq le_cbit
le_sbit orab  0,y    ; set it from mask
  bra le_tbit
le_cbit comb       ; clear it from mask
  andb  0,y
le_tbit stab  0,y
  bra le_2x
le_latch
  pulb
  ldx PLC
  ldaa  lv_sign,x
  bita  #$04
  bne le_sbit
  bra le_2x
le_unlatch
  pulb
  ldx PLC
  ldaa  lv_sign,x
  bita  #$04
  bne le_cbit
  bra le_2x

; three byte ops:
;  stack is value.w (or .b.b), nextOp.w
;  for put y^ is counter
j_3b4 equ *-$0040   ; math K.w
  db  le_get-*
  db  le_plus-*
  db  le_minus-*
  db  le_cmp-*
  db  le_times-*
  db  le_gozinta-*
  db  le_put-*
le_get
  ldx PLC
  pula      ; value
  pulb
  std lv_acc,x
le_3x bra le_2x
le_plus
```

```
  ldx PLC
  ldab  #$fd     ; clear less bit
  andb  5+lv_ios,x
  stab  5+lv_ios,x
  pula       ; value
  pulb
  addd  lv_acc,x
  std lv_acc,x
  bvc le_3x
le_less ldab  #$02     ; set less bit
le_sleg orab  5+lv_ios,x
  stab  5+lv_ios,x
  bra le_3x
le_minus
  ldx PLC
  ldab  #$f1     ; clear less,equal,greater
  andb  5+lv_ios,x
  stab  5+lv_ios,x
  ldd lv_acc,x
  puly
  sty lv_temp,x
  subd  lv_temp,x
  std lv_acc,x
le_leg  bcs le_less    ; if goes minus, r<op
  beq le_equ
  ldab  #$08     ; if r>op
  bra le_sleg
le_equ  ldab  #$04     ; if r=op
  bra le_sleg
le_cmp
  ldx PLC
  ldd lv_acc,x
  puly
  sty lv_temp,x
  cpd lv_temp,x
  bra le_leg
le_times
le_gozinta
  jmp le_unimp
le_put
  pulx       ; dump values
  ldx PLC
  ldd lv_acc,x
  std 0,y
  bra le_3x

j_3b5 equ *-$0050
  db  le_jmz-*  ; d.w
  db  le_jmp-*
  db  le_nop3-*
  db  le_nop3-*
  db  le_shf-*  ; r.b, r.b
  db  le_rsf-*
  db  le_pack-*
  db  le_unpack-*
  db  le_cntdn-*  ; t.b, r.b
  db  le_read-* ; i.b, i.b
le_jmz
  ldx PLC
  ldaa  lv_sign,x ; state of rung
```

```
  bita  #$04
  beq le_jmp    ; jump if not true
  pulx      ; else dump displacement
  pulx
  jmp plc_cycle
le_jmp
  tsx      ; point at disp, next
  ldd 0,x   ; to get address of next op
  addd  2,x
  puly      ; adjust stack
  puly
  xgdx      ; and go to wherever
  jmp plc_cycle
le_rsf
  ldx PLC
  ldab  lv_sign,x
  bitb  #$04     ; if it's true
  beq le_3xxx
  pulb      ; get the 1st to clear
ler_1 pshb      ; save it while clearing
  clra
  jsr lo_bit    ; get mask, address
  comb      ; to clear it
  andb  0,y
  stab  0,y
  pulb      ; look see
  pula      ; if last one
  cba
  beq le_3xx    ; yes if b=a
  psha      ; else save last
  incb      ; and go do next
  bra ler_1
le_shf
  ldx PLC
  ldab  lv_sign,x
  bitb  #$04     ; if it's true
  beq le_3xxx
  clr lv_temp,x ; assume first is off
  pulb
les_1 incb      ; go to next
  pshb      ; save while busy
  clra
  jsr lo_bit    ; get mask, address
  ldx PLC
  pshb      ; save mask for a sec
  andb  0,y   ; to get old value
  tst lv_temp,x ; then look at last relay
  pula      ; to use mask
  bne :+1   ; to set it
  coma      ; or clear it
  anda  0,y
  staa  0,y
  bra :+2
: oraa  0,y
  staa  0,y
: stab  lv_temp,x ; and save old for next
  pulb      ; see if done
  pula
  cba
  beq le_3xx    ; if are
```

```
  psha      ; else  ve
  bra les_1
le_pack
  ldx PLC
  ldab  lv_sign,x
  bitb  #$04    ; if it's true
  beq le_3xxx
  clra
  clrb
  std lv_acc,x  ; start with all off
  pula        ; the last one (lsb)
  pulb        ; the first one
  psha
lep_1 pshb      ; save while packing
  clra
  jsr lo_bit    ; get mask, address
  andb  0,y   ; check bit
  addb  #$ff    ; sets carry if on
  ldx PLC
  rol lv_acc+1,x  ; to roll into accumulator
  rol lv_acc,x
  pulb        ; see if done
  pula
  cba
  beq le_3xx    ; if are
  psha        ; else save
  decb        ; to do next
  bra lep_1
le_3xxx pulx      ; dump params
le_3xx  pulx
  jmp plc_cycle
le_unpack
  ldx PLC
  ldab  lv_sign,x
  bitb  #$04    ; if it's true
  beq le_3xxx
  ldd lv_acc,x  ; use temp to roll out
  std lv_temp,x
  pulb        ; first to set (lsb)
leu_1 pshb      ; save while packing
  clra
  jsr lo_bit    ; get mask, address
  ldx PLC
  ror lv_temp,x ; roll from accumulator
  ror lv_temp+1,x ; into carry
  bcs :+1     ; to set it
  comb        ; to clear it
  andb  0,y
  stab  0,y
  bra :+2
: orab  0,y
  stab  0,y
: pulb        ; see if done
  pula
  cba
  beq le_3xx    ; if are
  psha        ; else save
  incb        ; to do next
  bra leu_1
le_nop3
```

```
le_cntdn
le_read
  jmp le_unimp

; four byte ops:
;  stack is tc.b, constant.w, nextOp.w
j_4b  equ *-$0070    ; base of 4 byte ops
  db  le_tap-*
  db  le_setc-*
  db  le_pset-*
  db  le_hsc-*
le_setc
  ldx PLC
  clra       ; d is tc number
  pulb
  puly       ; save constant in frame
  sty lv_temp+2,x
  pshb
  asld       ; times two
  addd  #lv_cnts  ; plus offset
  addd  PLC   ; plus frame start
  std lv_temp,x ; stash ^count in frame
  pulb       ; tc number again
  tba
  lsrb
  lsrb
  lsrb       ; byte number of done flag
  addb  #lv_tcds  ; with offset
  ldy PLC    ; points y to byte
  aby
  tab      ; get bit num back for mask
  andb  #$07
  ldx #lo_masks
  abx
  ldaa  0,x   ; mask in a, ^done in y

  ldx PLC   ; first look at this rung
  ldab  lv_sign,x
  bitb  #$04     ; if it's true
  bne le_rset    ; then reset tc
  bita  0,y   ; now see if already done
  bne le_setr    ; just set rung flag if so

  ldab  lv_bump,x ; now see if bump is there
  beq le_setf    ; set rung false if no
  bpl le_seta    ; do bump if from time
  pshy       ; save address of done flag for a sec
  ldab  #lv_tcrs-lv_tcds ; so we can check count rung flag
  aby      ; which is at done+#tcs/2
  bita  0,y   ; this is what it was
  puly       ; restore address of done flag
  bne le_sett    ; if still true and waiting
  ldab  #$01     ; if an edge bump count
le_seta psha       ; save mask for a sec
  pshy       ; as well as ^done
  clra       ; d is bump
  ldy lv_temp,x ; y is ^count
  addd  0,y
  bcc :+1
  ldd #$ffff    ; stop at max
```

```
: std 0,y
  cpd lv_temp+2,x ; compare to constant
  puly
  pula
  bcs le_setr
  tab      ; if there, use mask
  orab  0,y   ; to set done flag
  stab  0,y
le_setr ldab  #lv_tcrs-lv_tcds ; get to rung flag to set it
  aby      ; which is at done+#tcs/2
  tst lv_bump,x ; bump <0 is counting and true
  bmi le_sett   ; so do it
le_setf coma      ; else show it false
  anda  0,y
  staa  0,y
  bra le_setx
le_sett oraa  0,y
  staa  0,y
  bra le_setx
le_rset tab     ; reset, use mask
  comb
  andb  0,y   ; to clear done flag
  stab  0,y
  pshy
  ldy lv_temp,x
  clr 0,y   ; and clear counter
  clr 1,y
  puly
  bra le_setr   ; then go save state of rung

le_pset
  pulb
  pulx      ; get value
  ldy PLC
  ldaa  lv_sign,y
  bita  #$04    ; if it's true
  beq le_setx
  clra      ; then d is tc number
  asld      ; times two
  addd  #lv_cnts  ; plus offset
  addd  PLC   ; plus frame start
  xgdx
  std 0,x   ; put it there
le_setx pulx      ; nextop back
  jmp plc_cycle
le_tap
  ldx PLC
  clr lv_sign,x ; assume no hit
  clra      ; d is tc number
  pulb
  asld      ; times two
  addd  #lv_cnts  ; plus offset
  addd  PLC   ; plus frame start
  xgdx      ; *count in x
  pula      ; constant in d
  pulb
  cpd 0,x
  bhi le_setx   ; if const>count
  ldx PLC
  ldaa  #$04    ; else hit it
```

```
  staa  lv_sign,x
  bra le_setx
le_hsc
  jmp le_unimp
```

The preferred embodiment of the present invention has now been described. This preferred embodiment constitutes the best mode contemplated by the inventor for carrying out his invention. Because the invention may be copied without copying the precise details of the preferred embodiment, the following claims particularly point out and distinctly claim the subject matter which the inventor regards as his invention and wishes to protect:

I claim:

1. An improved flying paster for splicing the leading edge of the leading end of a new web of material, which is wound, as a first roll, on and about a first central core, to the trailing end of a running web of material which is wound, as a second roll, on and about a second central core, which is running through and out of the flying paster as it is unwound from the second, running roll, the improved flying paster comprising:

first and second side walls that are spaced apart a distance greater than the widths of the first and second rolls and that have a bottom surface and an upper surface;

means for mounting the ends of the first central core for rotation with respect to the first and second side walls so that the new roll is disposed in a splicing position between the first and second side walls;

means for mounting the ends of the second central core for rotation with respect to the first and second side walls so that the second, running roll is disposed in an operating, unwinding position between the first and second side walls and so that the running web may be unwound from the second roll and may be thereafter run through and out of the flying paster;

a movable brake and roll accelerator assembly mounted in the flying paster adjacent and movable with respect to a side wall, with the movable brake and roll accelerator assembly being movable between a first position adjacent to the splicing position and a second position adjacent to the operating position;

a fixed brake and brake accelerator assembly mounted in the flying paster adjacent to a side wall and to the operating position;

means for selectively connecting an end of the first central core with the movable brake and roll accelerator assembly so as to enable the movable brake and roll assembly to cause and control rotation of the new roll;

means for selectively connecting an end of the second central core with the fixed brake and brake accelerator assembly so as to enable the fixed brake and roll assembly to cause and control the rotation of the second, running roll;

means for controlling the operation of selectively one of the fixed brake and brake accelerator assembly and the movable brake and roll accelerator assembly so that the running web is maintained under positive controlled tension, at all times, as it unwinds;

a tension control dancer mounted with the flying paster and so as to receive the running web as it exits from the flying paster, with the dancer including means for providing an input control signal to the controlling means concerning the web tension condition of the running web as it passes through the dancer, which signal functions to control the operation of the selected assembly so as to maintain the running web under positive tension control at all times;

means for causing a portion of the running web, which is downstream from the second, running roll, to run adjacent to the leading end of the web on the new roll;

means for causing the movable brake and roll accelerator assembly to rotate the new roll so that the speed of the new roll matches the speed of the running web;

means for cutting the running web when the running web is adjacent to the web on the new roll;

means for splicing the leading end of the new roll with the trailing end of the web then running from the second roll when the speed of the new roll matches the speed of the running web;

means for transferring the operational control of the selected brake and accelerator assembly from the fixed brake and brake accelerator assembly to the movable brake and roll accelerator assembly upon the splicing of the leading end of the new roll with the trailing end of the running web from the second roll;

means for disconnecting the second central core from the fixed brake and brake accelerator assembly after transfer of the operational control to the movable brake and roll accelerator assembly;

mean for moving the new, now-running roll from the splicing position to the operating position;

means for connecting an end of the first central core with the fixed brake and brake accelerator assembly so as to enable the fixed brake and brake accelerator assembly to cause and control rotation of the new, now-running roll;

means for disconnecting the end of the first central core from the movable brake and roll accelerator assembly after connection has been made between the first central core and the fixed brake and brake accelerator assembly; and

means for transferring the operational control of the new now running roll from the movable brake and roll accelerator assembly to the fixed brake and brake accelerator assembly upon disconnection of the first central core and the movable brake and roll accelerator assembly.

2. The improved flying paster of claim 1 which includes means for permitting the second central core, and any remaining web wound thereon, to be moved from the operating position, from the flying paster after disconnection of the second central core and the fixed brake and brake accelerator assembly.

3. The improved flying paster of claim 1, which includes means for moving the movable brake and roll accelerator assembly with the new, now-running roll, as the new roll moves from the splicing position to the

operating position, between its first position and its second position.

4. The improved flying paster of claim 3 which includes means for moving the movable brake and roll accelerator assembly from its second position to its first position after disconnection of the end of the first central core from the movable assembly.

5. The improved flying paster of claim 1 which includes means for causing the movable brake and roll accelerator assembly to accelerate the new roll, prior to splicing, such that the diameter of the new roll, the weight of the new roll, the angle between a brake pulse and a predetermined colored mark on the new roll, the frictional forces involved, and the efficiency of the movable assembly can be calculated.

6. The improved flying paster of claim 2 which includes means for moving the movable brake and roll accelerator assembly with the new, now-running roll, as the new roll moves from the splicing position to the operating position, between its first position and its second position.

7. The improved flying paster of claim 6 which includes means for moving the movable brake and roll accelerator assembly from its second position to its first position after disconnection of the end of the first central core shaft from the movable assembly.

8. The improved flying paster of claim 7 which includes means for causing the movable brake and roll accelerator assembly to accelerate the new roll, prior to splicing, such that the diameter of the new roll, the weight of the new roll, the angle between a brake pulse and a predetermined colored mark on the new roll, the frictional forces involved, and the efficiency of the movable assembly can be calculated.

* * * * *